GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

Power

September
1952 · 50¢
A McGRAW-HILL PUBLICATION

Worlds of water—*a special report—71*

A lot of engineering for a Component!

Converter's job in Speedomax instruments is to receive the (often very small) direct current signal which is related to the temperature, stress pH or other condition being measured, and produce an alternating voltage. This output is amplified, and then directs the balancing system to measure, record, and if desired control.

and every Speedomax user benefits by it!

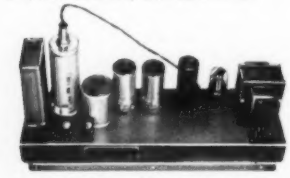
● The operating precision of the thousands of Speedomax Recorders and Controllers which serve industry and science begins with the engineering of components like this Converter. Our specifications apply at all stages—all the way back to the plants which make metals, insulation materials, etc., for us. These specs represent also the best thinking of our suppliers' engineers. The resulting materials are thus quality-controlled for us—and us alone.

From these materials our engineers tell our factory how to make converter parts to truly tight specifications. Some parts require principally flatness, or elasticity, or dimensional stability. Reeds need correct natural frequency. Many parts of course combine various needs; each gets its requirements.

Life tests show Fidelity and Stamina. Ingenious and often original design creates from these parts a converter with noise level equivalent to only 0.2 microvolt in an emf potentiometer circuit. And this fidelity promotes accurate measurement and control.

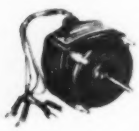
Running on life tests since 1948, present-model converters are today still well inside performance tolerances. Such a run equals 21.9 years of 8-hours-a-day, 200-days-a-year-service—or 1.9 years more than the present age of the first Speedomax.

This kind of engineered performance is also built into the amplifier, slidewire, motor and scores of other exclusively Speedomax parts. It's at your service whether you want to control a super heater or record temperature anywhere from coal pile to bus bar. Call on L&N application engineers in selecting the exact range (from among thousands) and the exact measuring circuit (from among 2300) to meet your needs. Write our nearest office, or 4910 Stenton Avenue, Philadelphia 44, Pa.



Good engineering shows in this Amplifier's thorough filtering, high impedance, and plug-in connection to the rest of the Speedomax.

Good engineering shows in this Slidewire's non-inductive winding and in absence of any flexible leads which might form inductive loops.



Good engineering shows in this balancing motor's small size, and in its torque ample to operate accessory control and signalling fitments.

CAREER OPPORTUNITIES AT L&N

Expansion program of this long-established firm has many features to attract outstanding recent graduates in engineering and science. Opportunities are in sales field engineering, product and application engineering, research, advertising, market development. Widely-respected policies assure recognition of progress and achievement. Address Personnel Manager for preliminary interview at nearest of 17 L&N offices.

LEEDS NORTHRUP

instruments • automatic controls • furnaces

Jrl Ad ND46(6d)

For top belt-conveyor efficiency, top power plant men rely on LINK-BELT

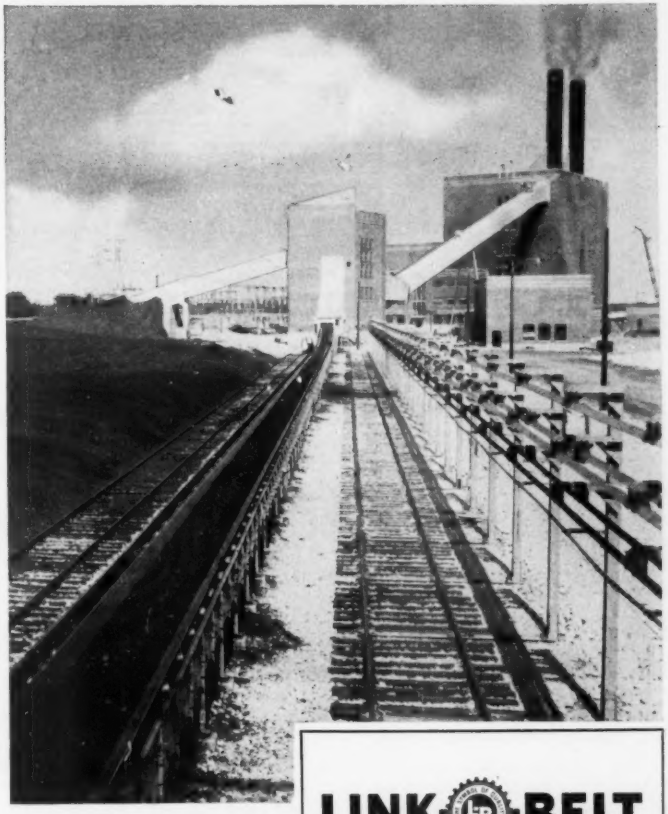
LINK-BELT engineering experience plus quality components combine to cut handling costs

Yes, in power plants everywhere, Link-Belt is first choice in belt conveyors. Whether your job is large or small, Link-Belt can apply unequalled engineering experience to meet the conditions of your particular system.

Link-Belt builds a complete line of quality components. Our conveyor engineers can choose from all types and sizes of idlers, trippers and terminal machinery to match your exact requirements.

Link-Belt can also supply all related equipment — other types of conveyors, feeders, elevators, car dumpers and shakers. And Link-Belt will build your supporting structures and enclosures . . . install the job completely if desired.

Link-Belt will gladly work with your engineers or consultants. Get in touch with your nearest Link-Belt office.



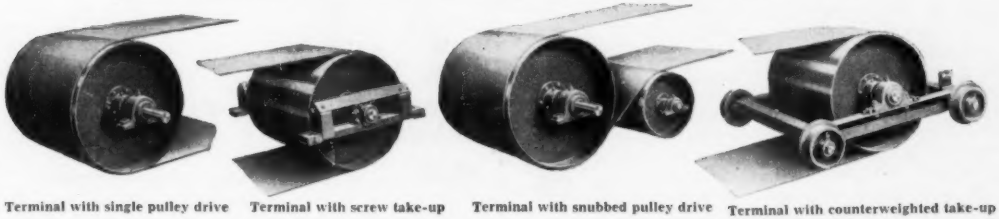
Link-Belt belt conveying equipment for storing, reclaiming and conveying coal to power plant bunkers. System has capacity of 1800 TPH from boats to storage.

LINK-BELT

BELT CONVEYOR EQUIPMENT

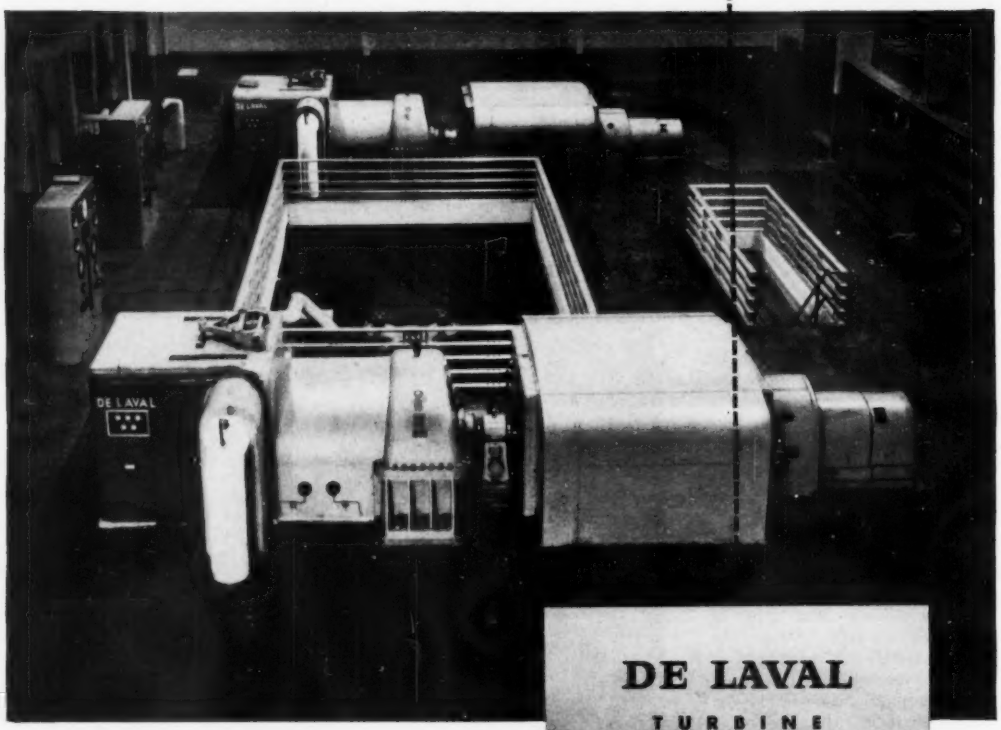
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities. 12,747

LINK-BELT Pre-Selected Terminals—the right equipment for every requirement



Terminal with single pulley drive — Terminal with screw take-up — Terminal with snubbed pulley drive — Terminal with counterweighted take-up

Two thoroughbreds for the blue grass country



You are looking at "13,400 horses" that will never run in the Derby. But these two 5,000 kw De Laval Turbine Generators, installed in the municipal power plant of the City of Henderson, Kentucky, add a new, dependable source of power to the famous blue grass country. Operating conditions are 600 psi at 825F and the turbines are arranged with three points of extraction for feedwater heating.

De Laval's modern Turbine Generators come from a long, pedigreed line. In fact, we have been building turbine generators for more than a half century. You can count on De Laval units to give you year-in, year-out service. Sizes range from 25 to 11,500 kw.

Be sure to send for complete data on our power plant equipment: boiler feed pumps, mechanical drive turbines, centrifugal pumps and IMO rotary oil pumps.

DE LAVAL *Turbine Generators*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

DL 183

Power

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WORLDS OF WATER is a fitting title for our cover drawing, showing the ocean currents that exert fundamental influences on the weather, hence on rainfall and water supplies. Quite literally, these oceans are the worlds of water, from which comes all we have, distilled by energy from the sun.

The cover title also implies that we have "worlds" of water. This, too, is true—in the U.S. we use only a fraction of total water available to us. Yet we have shortages. There are good reasons for this apparent paradox. Digging them out made writing our special report on WATER (pp 71-118) a fascinating job. We hope it proves interesting to you in the reading.

Next month...

■ Every so often we're asked for information on recovery of carbon dioxide from boiler flue gas. So we're glad to have a chance to describe, in October, a modern CO_2 installation in Ehret Magnesia Mfg Co's new power plant.

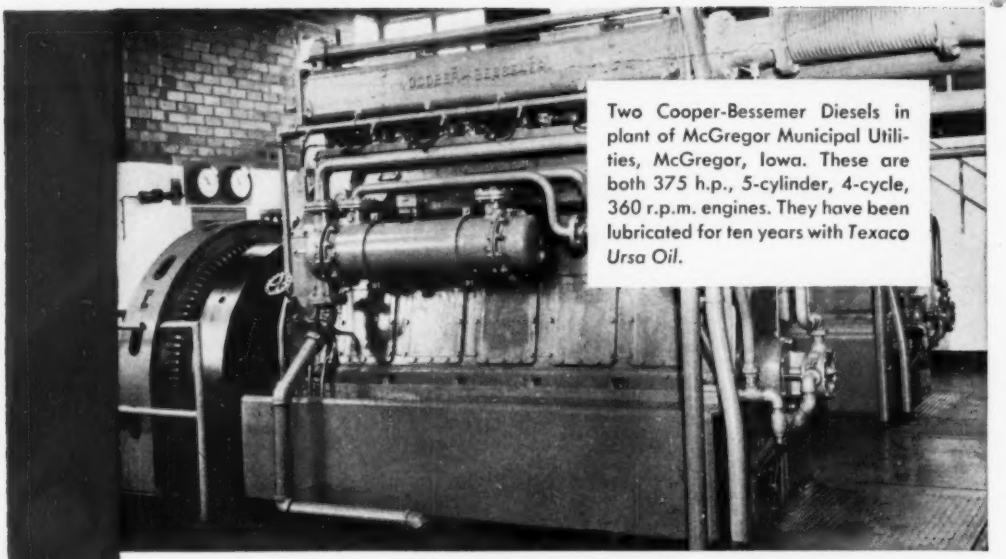
■ With the development of many specialized alloy rods, hard surfacing has become an increasingly versatile maintenance tool—one that every power engineer should have in his know-how kit. Sharpen up by looking over next month's pointers. And while you're at it, take a glance at some new time-saving slants on cable splicing.

■ October sees the beginning of a number of articles planned to cover the entire field of electrical construction—from advance planning through layout and actual building to the final testing.

■ By popular demand, we're showing, next month, another "4-star" film story—How and Why of Centrifugal Pumps.

...and future months

■ In the six years since we published our comprehensive report on gas turbines (Oct 1946), there's been a lot of progress. You'll realize how much when you read our upcoming survey. Besides reporting latest developments in plants and components, it will review basic principles, compare performances graphically, and carry the second world-wide survey of gas-turbine units.



Two Cooper-Bessemer Diesels in plant of McGregor Municipal Utilities, McGregor, Iowa. These are both 375 h.p., 5-cylinder, 4-cycle, 360 r.p.m. engines. They have been lubricated for ten years with *Texaco Ursa Oil.*

"We've used TEXACO URSA OIL for over 10 years and can state that it

KEEPS DIESELS CLEAN ...KEEPS COSTS LOW"

— says Raymond A. Trygg, Superintendent, McGregor (Iowa) Municipal Utilities

Mr. Trygg states further regarding the outstanding performance of *Texaco Ursa Oil:* "When our Diesels were last opened up — for their first inspection in two years—they were found to be clean and there was no measurable wear on pistons, rings, liners or bearings."

Because of the exceptional engine cleanliness assured with *Texaco Ursa Oil,* operators everywhere get longer parts life, lower maintenance costs, less fuel consumption, lube oil economy. Latest annual figures, for example, show that McGregor gets 12,469 h.p. hours per gallon of *Texaco Ursa Oil.*

Whether you're operating Diesel, gas or dual-fuel engines, there is a *Texaco Ursa Oil* that is exactly right for the size and type of your engines, and your particular operating conditions. Leading engine builders approve *Texaco Ursa Oils,* and they are easily America's favorite. In fact —

For over 15 years, more stationary Diesel h.p. in the U.S. has been lubricated with Texaco than with any other brand.

Let a Texaco Lubrication Engineer help you keep your Diesel efficiency high, your costs low. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO URSA OILS

FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

Faithfully yours 50 *for Fifty Years*

Power

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...with Power readers...

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Some time ago we received a copy of the special section "Steam Generation" to aid us in revision of . . . Lecture 9 on steam boilers . . . Before putting this lecture into distribution, we would request . . . permission to use figures . . . taken from "Steam Generation." The material was of considerable value to us and I wish to express our deep appreciation of your cooperation.

J A MIDDLETON
Provincial Institute of Technology and Art
Calgary, Alberta, Canada

POWER'S special sections, and materials excerpted from them, have found wide use in technical schools of all kinds, and in many industrial training courses. We're always glad to help those engaged in such work by granting permission to use text material or illustrations. The only formality —but a necessary one—is a letter of request stating the purpose for which the material is to be used, and listing the exact items to be reproduced.—ED.

THOSE EUROPEAN COOLING TOWERS . . .

I have read with considerable interest A E Farmer's article on England's big new cooling towers (July 1952). In spite of the fact that such hyperbolic cooling towers are common landmarks throughout the globe, their construction in this country

(*Continued on page* 208)

...lines and bylines

Marschalek, Rowley, Sutnar, Swain and "visuals"

WATER, WATER, EVERYWHERE aptly describes the POWER office atmosphere of the past ten months. We've been saturated with the oddly fascinating stuff since we started on our special report (p 71).

From the beginning, it was a team job, enlisting not only a good part of our regular staff but a battery of specialists. When we made our first decision—to cover all phases of water and not just the industrial angles—we started one team on basic research. Ben Skrotzki took on the meteorology and hydrology, Joe McCabe dug into the political and social angles, and Ty Hicks attacked the "in the plant" applications. After several months of talking to experts and soaking up basic information, each came up with an extensive report and a slew of ideas for key illustrations.

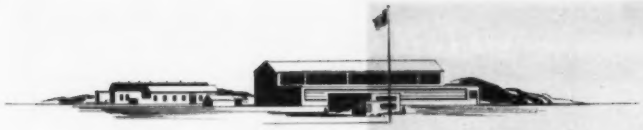
Then Phil Swain, Lou Rowley and Charlie Marschalek sat in to decide what should go into the final report, how it should be organized. It didn't take long to see we could tell most of the story with pictures and headlines reading from page to page.

With our blue chips on the illustrations, we added a specialist to the team—Ladislav Sutnar, former Director of the State School of Graphic Arts in Prague and internationally known as a "designer of information." His crisp style is evident in the unusually fine drawings.

The home stretch was fun or just a lot of hard work, depending on how you look at it. While we wrote and rewrote to get verbal ideas across in the quickest style, Bela Reiter and his artists in the McGraw-Hill illustration department labored to capture in finished art the graphic ideas of Sutnar and Marschalek.

That, you might think, was it. But in topflight reporting you always expose your ideas and facts to the best critical eyes you can find. We did, and we're sincerely grateful for the real help we got from many of the nation's top water specialists.

Skrotzki, McCabe, Hicks and California water map



From B&W Research and Development . . .

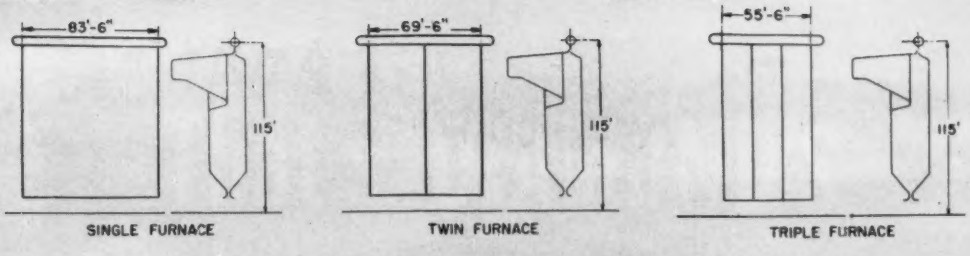
a practical solution to cost problems...

B&W DIVIDED

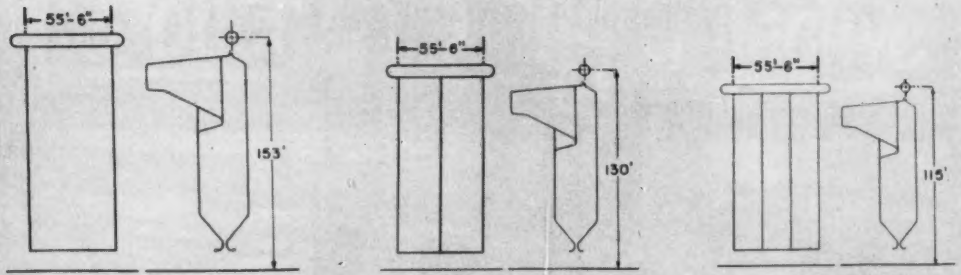
A practical, long-proved solution to rising construction costs may be found in the B&W Divided-Furnace Boiler. Whether it is a problem of conserving height, width, or both—especially for units with large heat input—B&W's Divided-Furnace design offers remarkable economies. The sketches on the opposite page show typical savings in space for twin-furnace and triple-furnace construction as compared with single-furnace construction.

A furnace division wall receives heat from both sides and therefore must be assured an adequate supply of water. With the B&W Cyclone-Steam Separator, circulation in division walls of B&W boilers has always been more than ample—as proved by long-term central station operation at boiler design pressures as high as 2650 psi. Many years of experience stand behind B&W's Divided-Furnace construction with all types of large units—Radiant, Stirling, and Open-Pass. Over 75 B&W Divided-Furnace Boilers are in operation—many for over 10 years—and more than 80 units are under construction, for the following electric utilities:

Alabama Power Company • Appalachian Electric Power Company • Arkansas Power & Light Company • Cincinnati Gas & Electric Company • City of Los Angeles • Cleveland Electric Illuminating Company • Commonwealth Edison Company • Consolidated Edison Company of N. Y. Inc. • Consolidated Gas, Electric Light & Power Company of Baltimore • Dallas Power & Light Company • Detroit Edison Company • Duquesne Light Company • Electricite France • Georgia Power Company • Houston Lighting & Power Company • Indiana & Michigan Electric Company • Jersey Central Power & Light Company • Kentucky Utilities Company • Long Island Lighting Company • Middle South Utilities, Inc. • Monongahela Power Company • Niagara-Mohawk Power Corp. • Northern Indiana Public Service Company • Ohio Edison Company • Ohio Power Company • Pacific Gas & Electric Company • Pennsylvania Electric Company • Philadelphia Electric Company • Public Service Company of Colorado • Public Service Company of Northern Illinois • Public Service Company of Indiana Inc. • Public Service Company of Oklahoma • Public Service Electric & Gas Company • Southern California Edison Company • Tennessee Valley Authority • Texas Electric Service Company • Texas Power & Light Company • Toledo Edison Corp. • Union Electric Company • West Penn Power Company • Wisconsin Power & Light Company



EFFECT OF DIVISION WALLS ON BOILER WIDTH—KEEPING HEIGHT CONSTANT



EFFECT OF DIVISION WALLS ON BOILER HEIGHT—KEEPING WIDTH CONSTANT

FURNACE

Division wall furnace construction is used in combination with other significant achievements of B&W Research and Development, including the Cyclone Furnace, Pressure-Firing, Gas Recirculation, and improved alloys for high steam temperatures. Widely accepted throughout the power industry, these modern B&W advances are making major contributions to more economical and reliable steam generation.

B&W's continuing program of progressive research combined with its broad experience in designing and building boilers with the highest capacities in existing pressure-temperature ranges, assure you of the most efficient and economical solutions to your specific steam generation problems.

ADVANTAGES OF DIVIDED FURNACE CONSTRUCTION

- Provides greater cooling area without increasing furnace volume
- Reduces steel and other material costs by keeping boiler and building volume to a minimum
- Lowers furnace construction costs
- Cuts operating costs by reducing slagging in furnace and in convection surface

Triple furnace boilers for 1 boiler—1 turbine units of over 200,000 KW capacity are now being constructed

BABCOCK & WILCOX

G-5697

"Clean Enough to Suit Aunt Lena"

According to "Kaffeeklatsch" gossip in Pittsburgh's German quarter (circa 1900), Aunt Lena scrubbed all the floors every day, washed the porch, steps and sidewalk and swept the street to the middle. Certainly she was an uncompromising and relentless enemy of dirt. Her house was so clean it excited the envy of the women, and frightened little children and husbands . . . no mean feat in the exacting colony of the "Scrubbin' Dutch".

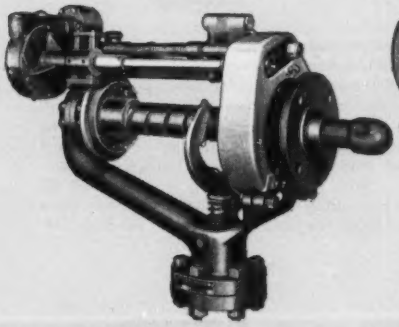
Aunt Lena became a legend and a standard of perfection. "Clean enough to suit Aunt Lena" became the hole in one, the one-round knockout, the no-hit pitching in those dirt-annihilation circles.

Probably it wouldn't be possible to keep a boiler clean enough to "suit Aunt Lena", but Diamond Blowers can and do keep them clean enough to meet the most exacting requirements of engineers throughout the country. Diamond gives you better boiler cleaning—at lower over-all cost.

DIAMOND POWER SPECIALTY CORP.
LANCASTER, OHIO
Diamond Specialty Limited—Windsor, Ontario

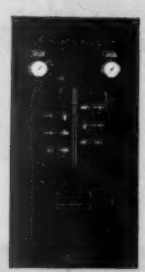
That's DIAMOND'S Boiler Cleaning Objective

Diamond Model IK Long Retracting Blower with mechanically operated valve. Air motor operated unit shown; also available electric motor operated.



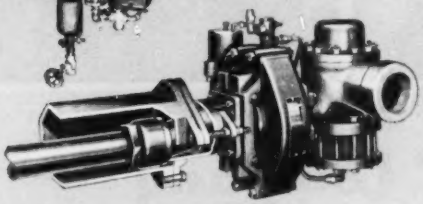
Diamond Model IR Short Retracting Blower with air motor operation; electric or manual operation also available.

Diamond Model G98 Automatic Valved Blower with electric motor operation; also available with air motor or manual operation.

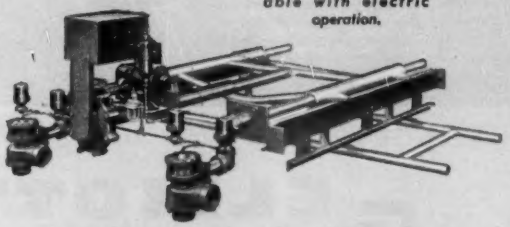


Diamond Panel for automatic control of complete cleaning cycle including all types of blowers. Air operation shown; also available with electric operation.

Diamond Master Controller for automatic control of Air Puff units.



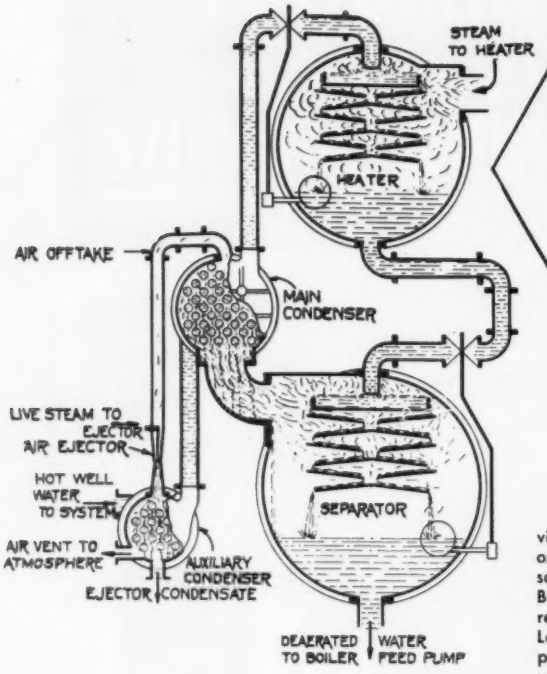
Diamond Model A2E Automatic Air Puff Blowers.



Diamond Automatic Air Heater Blower has air or electric operation . . . air or electric control.

4809

DEAERATION



THE FIRST DEAERATOR, DEVELOPED AND BUILT BY ELLIOTT IN 1918

After much research and experimentation in the virgin field of processing feedwater for the removal of oxygen, Elliott engineers in 1918 developed, built and sold the first practical commercial deaerating unit. By 1924 the supreme value of the achievement was recognized in the award to W. S. Elliott of the Edward Longstreth medal by the Franklin Institute, Philadelphia . . . With this commanding lead, backed by valuable pioneering experience, Elliott engineers have continued to set the pace in deaeration development.

HOW ELLIOTT BUILDS DEAERATING HEATERS

All the work is done right in the Elliott shops. Rolling of shells, welding and fabricating of parts is all handled by Elliott personnel. It's actually custom tailoring in metal, for every unit is built to fit its job.

Rolling a fair-sized shell.

ASME-approved automatic welding is used wherever possible.

ELLIOTT Company

DEAERATOR AND HEATER DEPARTMENT

N2-2

has come a long way!

THE ELLIOTT DEAERATING HEATER OF TODAY

1952

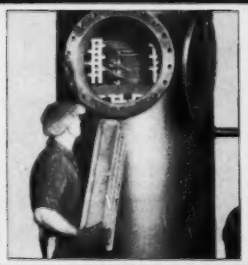
The modern Elliott deaerating heater combines the three stages of the deaerating process—heating, deaerating and venting—within a single shell, thus eliminating headroom problems and simplifying construction. The tubular vent condenser is replaced by a spray pipe and vent hood, both of stainless steel, which perform the functions of the clumsy, outmoded vent condenser with no maintenance other than occasional inspection. Here in itself is a major saving.

The entire heating section, and in fact all parts in contact with corrosive water, are of stainless steel. Trays, too, are of stainless steel—not only corrosion-free, but far lighter in weight—another factor for lower maintenance.

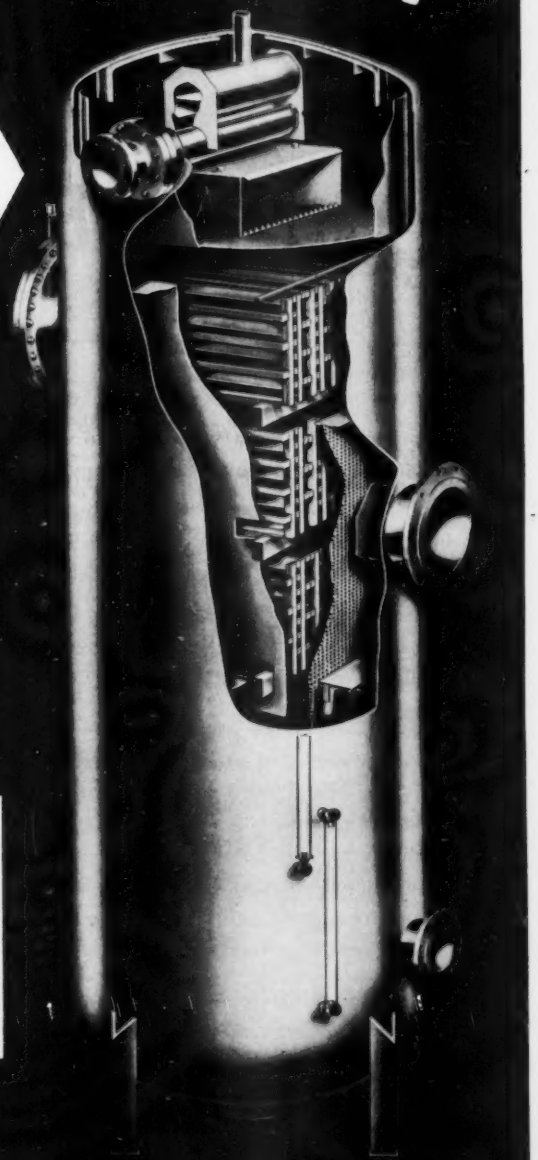
The picture at right shows the tray-type unit. The Elliott spray-type unit, developed largely for marine use, is also available.

For full details on Elliott deaerating heaters contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

Tack-welding a baffle-plate in place before final welding.



Stainless steel trays are no burden at all in manual handling.



How to the Efficiency Boiler-Room

Before you get steam you've got to spend dollars—so dollars are a form of energy.

And if your boiler-room dollars are invested in equipment that isn't working efficiently, economically, your "investment" is poor.

That's where co-ordinated controls by Bailey can help. Here's why they'll increase your "boiler-room investment efficiency":

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

•

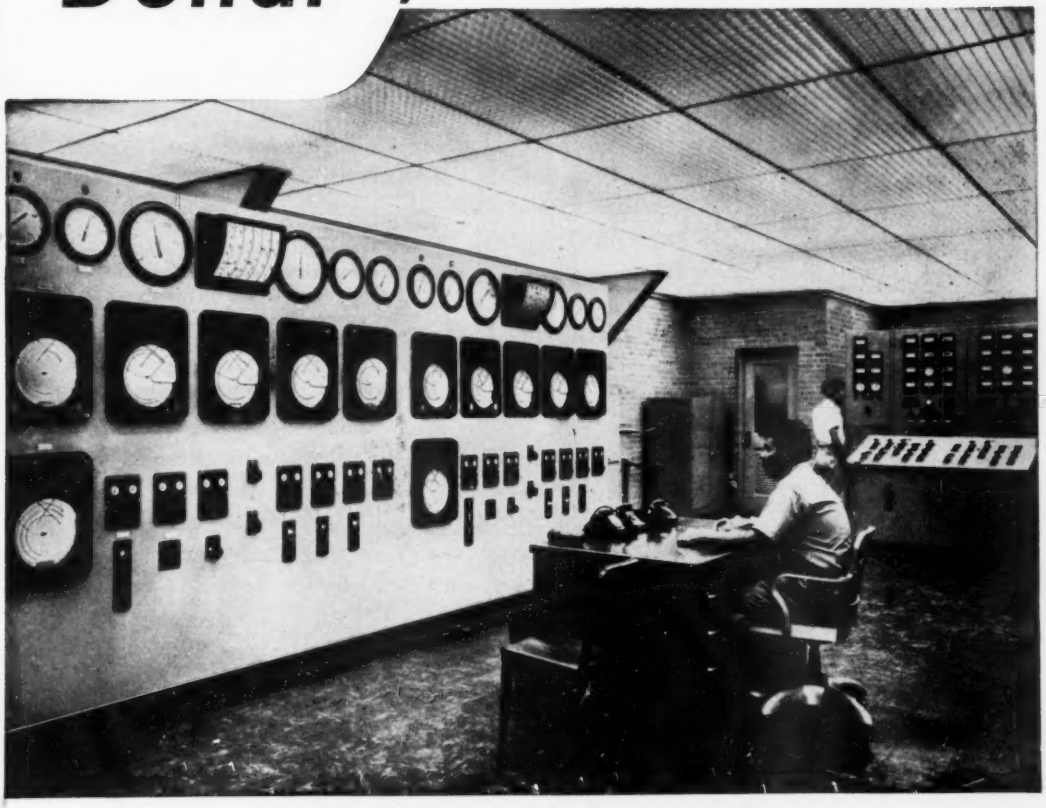
For better "boiler-room investment" efficiency—for more power per fuel dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

111-2

Controls for Steam Plants

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

INCREASE of YOUR Dollar



These Bailey Boiler Controls for Combustion, Feed Water, and Steam Temperature insure efficient operation of two 450,000 lb per hr, 1000 psi, 900 F, gas and oil fired boilers.

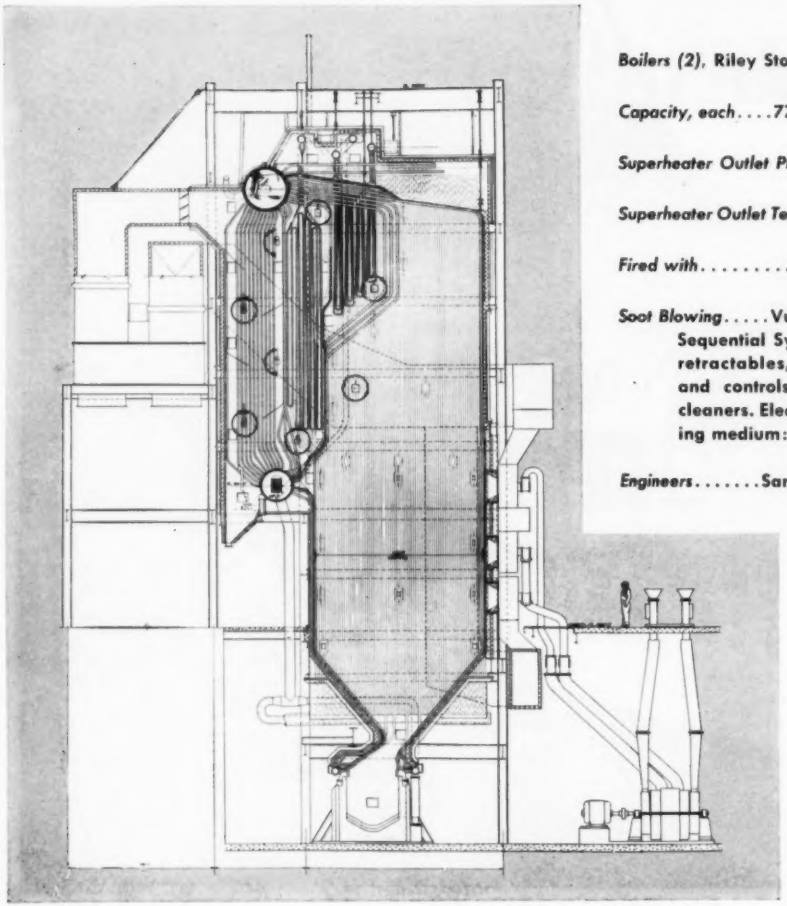
BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO
BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

ALBRIGHT

MONONGAHELA POWER COMPANY—

Outdoor boilers will be cleaned by a VULCAN



Boilers (2), Riley Stoker Corporation

Capacity, each....770,000 lb per hr

Superheater Outlet Pressure..910 psi

Superheater Outlet Temperature, 905 F

Fired with.....Pulverized coal

Soot Blowing.....Vulcan Automatic Sequential System with long retractables, wall blowers and controls for air-heater cleaners. Electric drive. Blowing medium: Steam.

Engineers.....Sanderson & Porter

VULCAN Automatic

STATION

THE POTOMAC EDISON COMPANY

All-Electric Automatic-Sequential System

BUILT at Albright, West Virginia, by Monongahela Power Company and The Potomac Edison Company, Albright Station will have its two new outdoor boilers cleaned by an all-electric Vulcan Automatic-Sequential System.

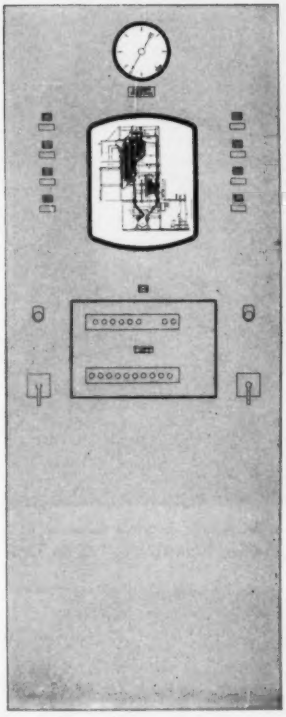
Soot blowing will be a simple matter of pushing a button to start the automatic sequence. If one location needs less cleaning than the rest, the blower can be cut out of sequence. If another needs more cleaning, blowing can be repeated at will.

There will be no need to patrol the boilers to make sure the job is being done. Each boiler will report back to the central panel on its operation.

And all-electric Vulcan drive means cleaner, more dependable operation. There will be no danger of freezing in control-air lines to the outdoor blowers.

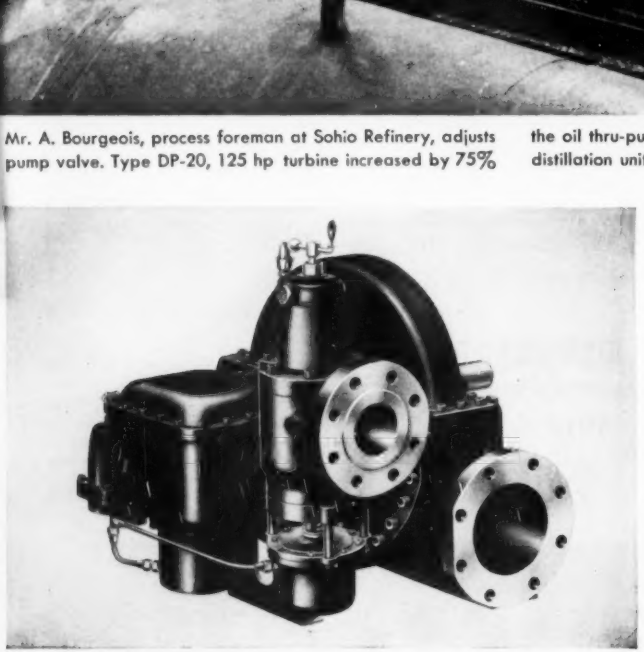
If you want effective, low-cost cleaning of your boilers—large or small, utility or industrial, power or process—depend on Vulcan. The oldest name in soot blowing will give you the latest word in results.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA



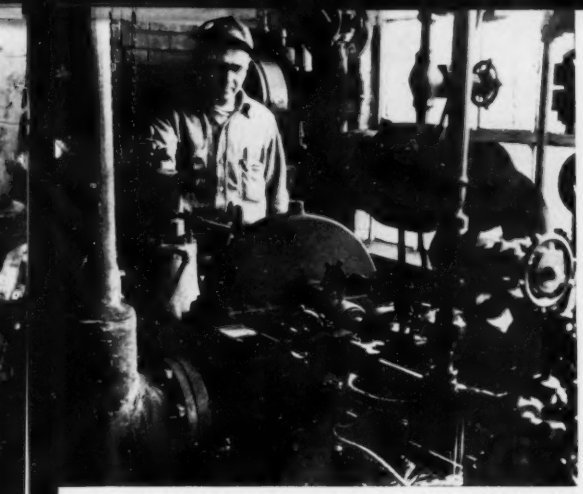
This central panel is the heart of the Vulcan Automatic-Sequential System. The operator has control of the entire soot blowing cycle at his fingertips at one central location. The sequence may be automatic or selective, or remote push button control may be used.

Mr. A. Bourgeois, process foreman at Sohio Refinery, adjusts pump valve. Type DP-20, 125 hp turbine increased by 75% the oil thru-put of this pump which supplies crude oil for the distillation unit.



Type DP MECHANICAL-DRIVE TURBINE

This Type DP turbine is one of General Electric's line of mechanical-drive turbines designed for driving pumps, compressors, blowers, etc. Their sturdy construction and many safety features make them ideal for industries having process steam requirements.



At Sohio's Toledo Refinery, this 15 hp, Type DP-16 turbine with non-sparking enclosed overspeed governor, safely pumps propane in an explosive atmosphere.

Mr. Eugene Ten Eyck and Mr. E. J. Bissonnette of Sohio Refinery discuss stocking of interchangeable parts for the Type DP turbines installed at the Refinery.

Sohio Refinery picks G-E turbine drives to increase oil thru-put

Engineers at Sohio's Toledo Refinery installed two G-E mechanical-drive turbines to help eliminate a bottleneck in refinery operations. A General Electric Type DP-20 turbine increased oil thru-put on one pump at Sohio by 75%, when it replaced older drive equipment. Total daily thru-put of the one pump now equals the former capacity of two pumps.

INSTALLED IN HAZARDOUS AREA

Sohio also installed a G-E Type DP-16 turbine in an explosive atmosphere to pump almost pure propane. The enclosed, non-sparking overspeed governor and the positive trip-throttle valve (which shut off all steam flow in case of overspeed) reduce hazards in this area. The turbine, which operates twenty-four hours per day, has required no maintenance during its first year of service.

VIBRATION REDUCED

Replacement of previous drive equipment with a G-E turbine now assures longer life to other machinery in the area. For G-E turbines with their center-line support and rigid assembly of buckets are now contributing to smooth operation at the refinery.

INTERCHANGEABLE PARTS

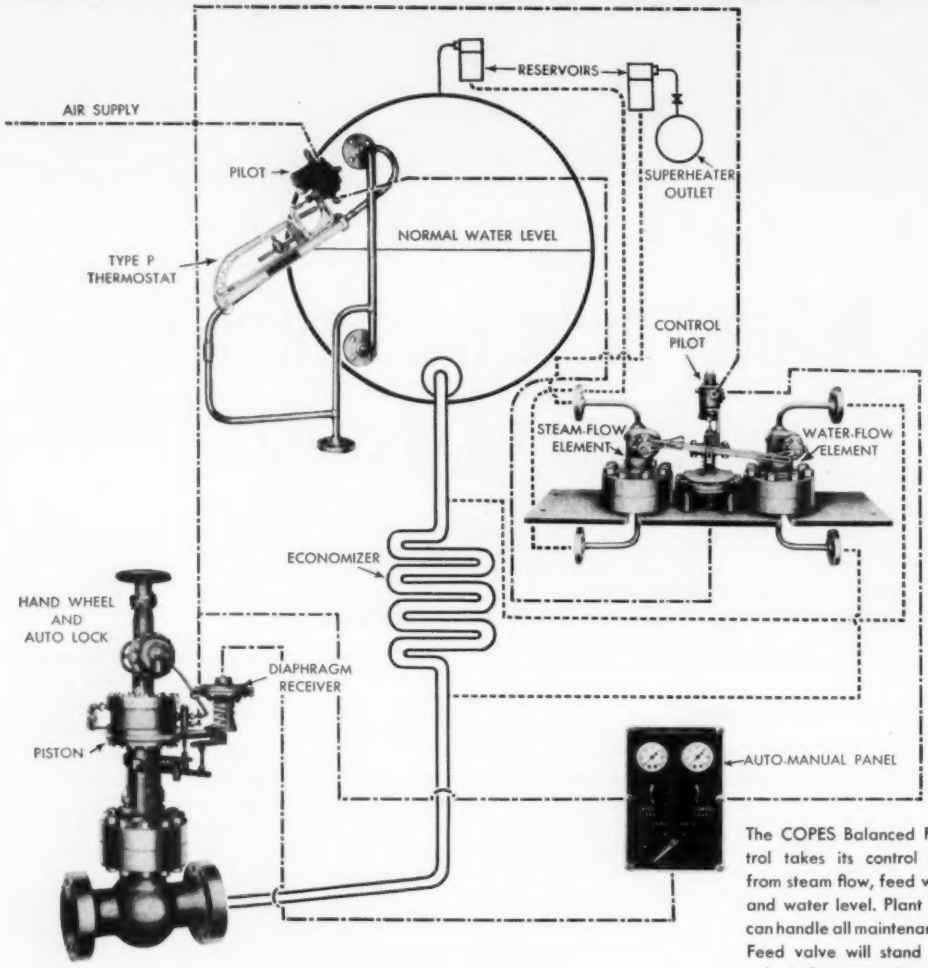
Use of G-E standard turbines can make stocking of spare parts a simple matter—most replacement parts are interchangeable among various frame sizes of G-E Type DP turbines. Stocking costs are cut, yet parts are available when needed.

This same parts standardization adds to the turbine's flexibility—often the turbine can be adapted to a new plant application with only minor adjustments. Horsepower range can be changed by substituting a different nozzle plate and valve parts.

For more information about the many advantages which these standardized turbines offer, call in your G-E sales-engineer or write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." Section 252-56, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

CONSUMERS POWER

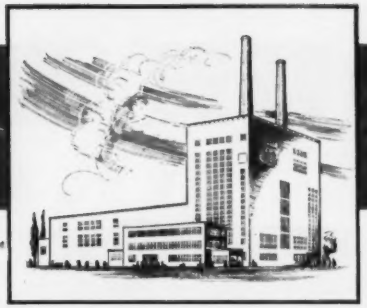


The COPES Balanced Flow Control takes its control influences from steam flow, feed water flow and water level. Plant personnel can handle all maintenance easily. Feed valve will stand up under *unlimited* pressure drops.

COPES

BOILER FEED

COMPANY



orders its 17th COPES Multi-Element Regulator

Add Justin R. Whiting Plant to the growing list of modern stations to have their boiler feeding under COPES Multi-Element Control.

Units 1 and 2, now being erected, will have 2-element COPES Flowmatics applied to hydraulic couplings of the boiler feed pumps.

Unit 3, recently ordered, will have 3-influence COPES Balanced Flow Control as shown schematically.

Whether you prefer one, two or three control influences for feeding your boilers, COPES can give you close level control and correct feed —without depending on any other instruments.

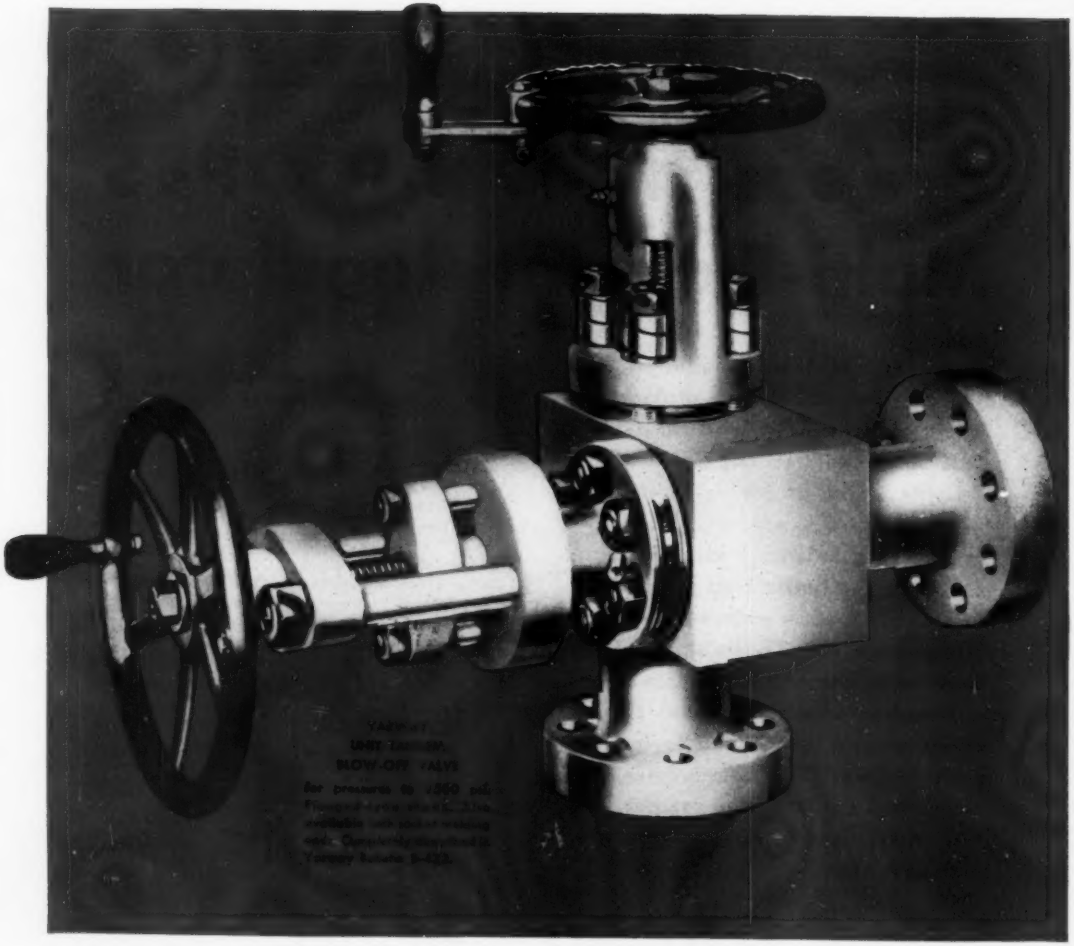
COPES MULTI-ELEMENT REGULATORS AT CONSUMERS POWER COMPANY

PLANT AND LOCATION	BOILER DATA No.	Make	WSP Psi	Max. Cap. Lb. per Hour
B. C. Cobb Plant Muskegon, Michigan...	3	C-E	875	600,000
Elm Street Plant Battle Creek, Michigan.	1	B & W	850	360,000
Bryce E. Morrow Plant Comstock, Michigan....	2	F W	875	400,000
	1	F W	875	550,000
	1	F W	875	600,000
John C. Weadock Plant Bay City, Michigan....	2	F W	875	400,000
	2	F W	875	550,000
	2	F W	875	600,000
Justin R. Whiting Plant Erie, Michigan.....	2	B & W	1600	690,000
	1	B & W	1600	860,000

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

WATER REGULATION

YOUR BOILER



YARWAY

IS WORTH A *GOOD* BLOW-OFF VALVE

Boilers represent sizable investments . . . certainly worth protecting with the most dependable boiler trim you can get.

You need good blow-off valves—valves that keep blow-down lines tight, don't wear, clog or leak, and are rugged enough to stand up under the severe shock of regular or emergency blowing-down under pressure.

Yarway Blow-Off Valves meet those requirements. Both Yarway Seatless Valves with balanced sliding plunger, and Yarway Stellite-faced Hard-Seat Valves embody the most recent developments in design and metallurgy.

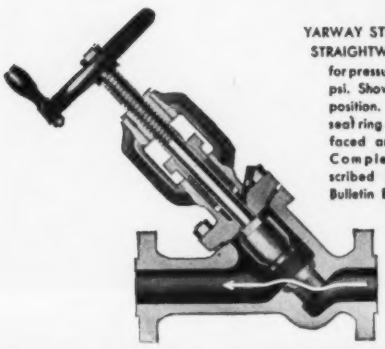
Engineers tell us the sturdiest of all blow-off valves is the Yarway Unit Tandem. This famous valve combines either a seatless and hard-seat, or two hard-seat valves, in a one-piece forged steel body. It is made for pressures up to 2500 psi. Other Yarway Blow-Off Valves meet lower pressure requirements.

It is significant that more than 15,000 plants throughout the world use Yarway Blow-Off Valves . . . and among the higher pressure plants, 4 out of every 5 are Yarway-equipped!

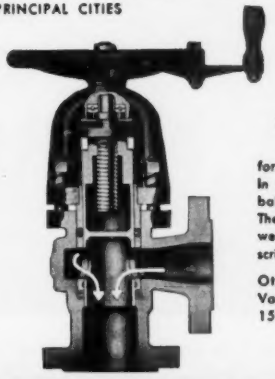
A Yarway bulletin will tell you in detail how these valves can protect *your* boiler investment. Write today, stating pressure range.

YARNALL-WARING COMPANY, 100 Mermaid Avenue, Philadelphia 18, Pa.

BRANCH OFFICES IN PRINCIPAL CITIES



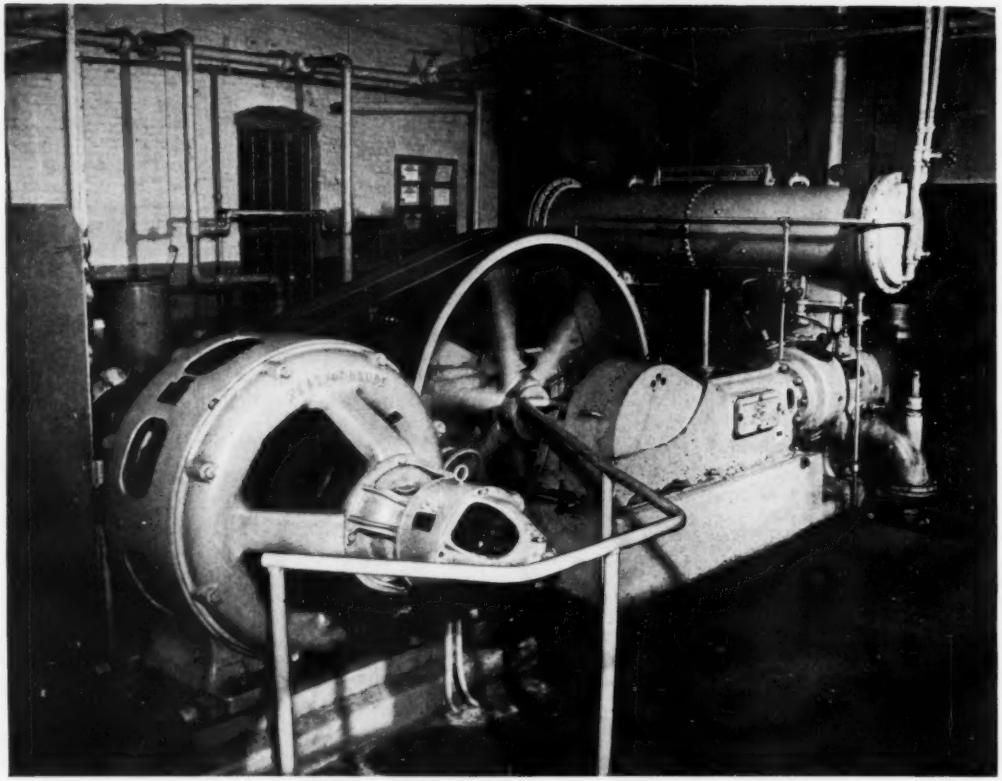
YARWAY STELLITE-SEAT STRAIGHTWAY VALVE for pressures to 2500 psi. Shown in open position. Disc and seat ring are stellite-faced and ground. Completely described in Yarway Bulletin B-432.



YARWAY TYPE "B" SEATLESS ANGLE VALVE for pressures to 400 psi. In open position. Notice balanced sliding plunger. There is no seat to score, wear, clog or leak. Described in Bulletin B-424.

Other Yarway Seatless Valves for pressures to 1500 psi.

"No Valve, Ring, or for Over 2 Years!"



The American Car and Foundry Company's huge plant at Huntington, West Virginia has been a user of Sinclair lubricants for over eighteen years. The results are of particular interest!

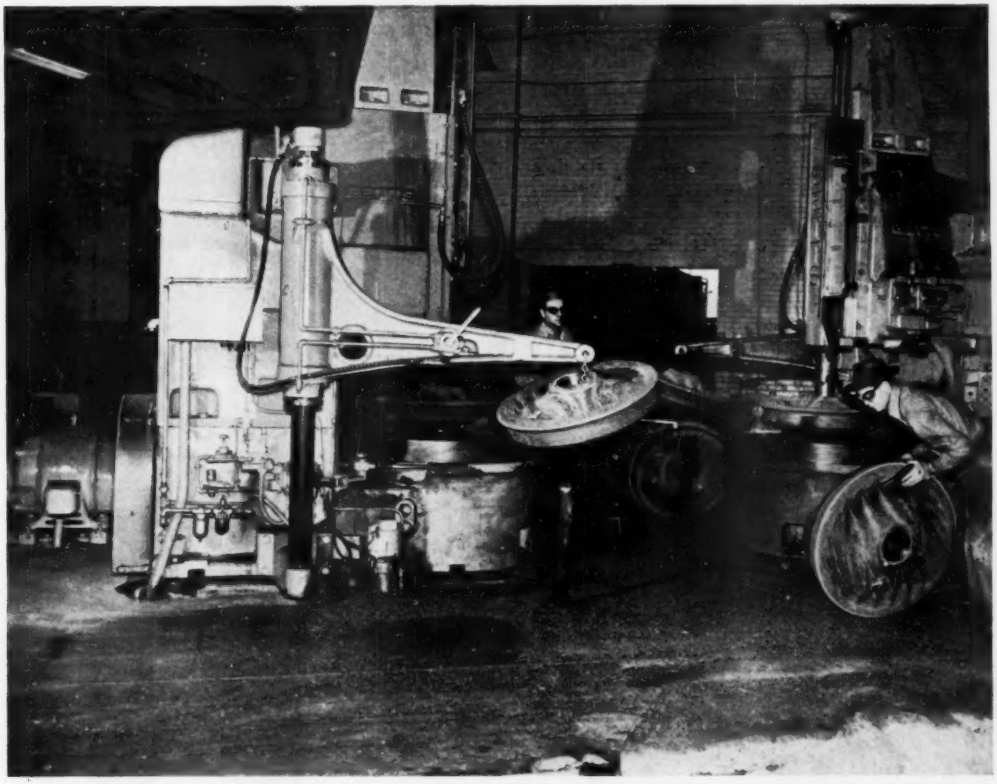
For example – the four compressors in the ACF plant are lubricated with Sinclair RUBILENE Medium. Proof of outstanding lubrication stamina is attested to by this service report: *"None of these compressors has required servicing of valves, rings, or bearings for over two years."*

Results speak volumes for this Sinclair Product. Why not investigate the advantages of RUBILENE Oils, available in *nine* viscosity grades? Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N.Y.

SINCLAIR RUBILENES®

Bearing Service

...SAYS THE AMERICAN CAR AND FOUNDRY COMPANY



"Rubilene has given Trouble-Free Service."

Further proof of RUBILENE quality is found in the operation of two Betts Heavy Duty Hydraulic Feed Car Wheel Bores. The American Car and Foundry Company says, "RUBILENE Oil Extra Light has given trouble-free service as the hydraulic fluid since these machines were put in service. No problem either, with chatter or sticking air hoists—RUBILENE Oil Medium in the air line lubricators does this job admirably."

for low maintenance costs

HALL LABORATORIES' SERVICE

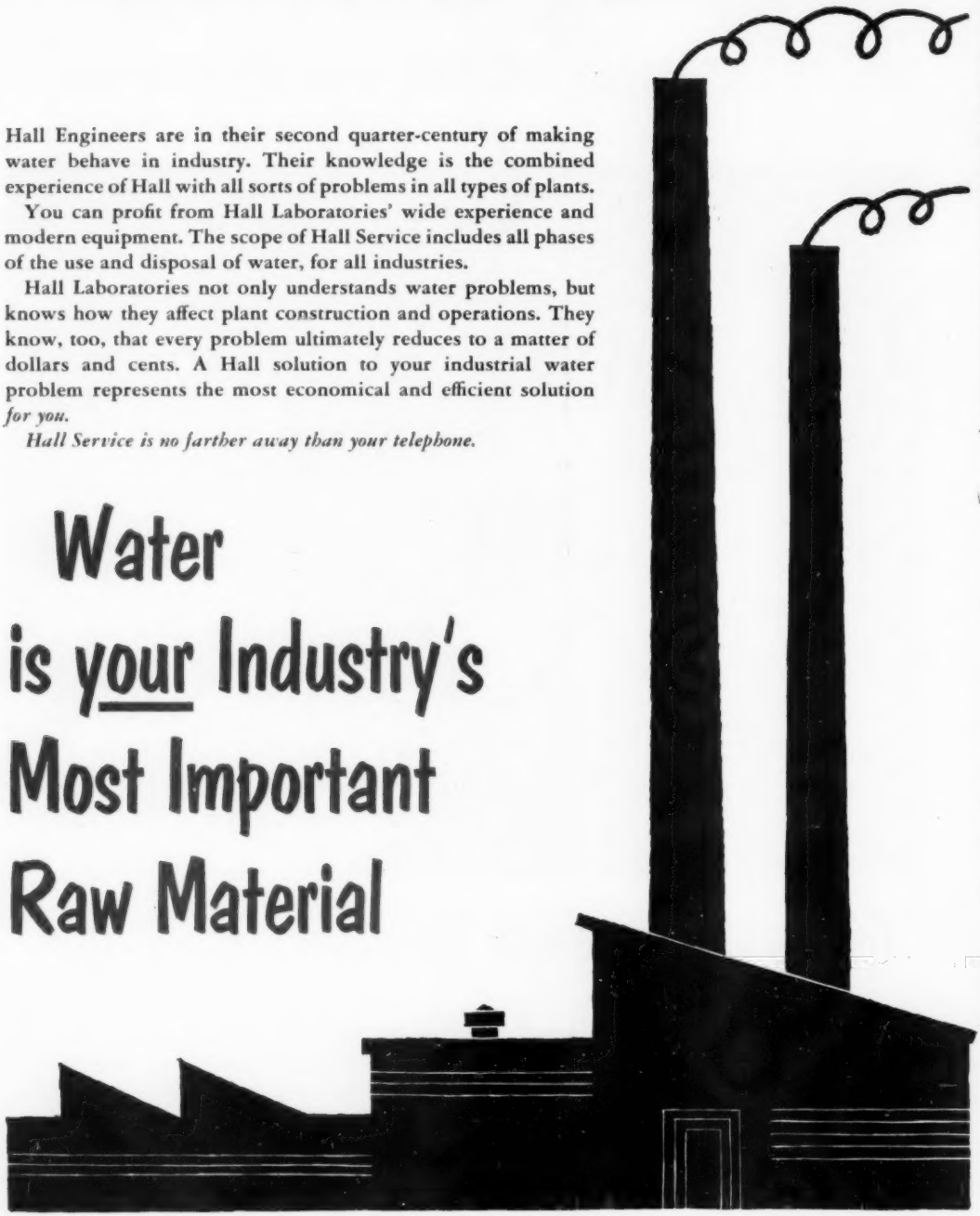
Hall Engineers are in their second quarter-century of making water behave in industry. Their knowledge is the combined experience of Hall with all sorts of problems in all types of plants.

You can profit from Hall Laboratories' wide experience and modern equipment. The scope of Hall Service includes all phases of the use and disposal of water, for all industries.

Hall Laboratories not only understands water problems, but knows how they affect plant construction and operations. They know, too, that every problem ultimately reduces to a matter of dollars and cents. A Hall solution to your industrial water problem represents the most economical and efficient solution *for you.*

Hall Service is no farther away than your telephone.

Water is your Industry's Most Important Raw Material



for any plant water problem

HALL LABORATORIES INC. can help you take corrective action on problems of

• WATER PROCUREMENT

In a region where water rights are precious, Hall Engineers increased the flow of a plant well at a fixed drawdown from 320 to 600 gpm. by a simple, safe chemical cleaning.

• PLANT PROCESS WATER

Industry specialists associated with Hall developed an inexpensive method of reducing deposition of pitch in a groundwood pulp mill.

• COOLING WATER

When serious corrosion of process equipment threatened production of edible oil, Hall Engineers worked with Plant Engineering Department. Together, they diagnosed problem, evolved successful treatment.

• BOILER WATER CONDITIONING

Hall Engineers provide systematic and practical service to keep boilers from coming off the line because of troubles due to water. Using his nose, good sense, and a conductivity meter, a Hall man traced condensate contamination in food processing plant to leaking equipment. Repair of leaks stopped carryover from boilers.

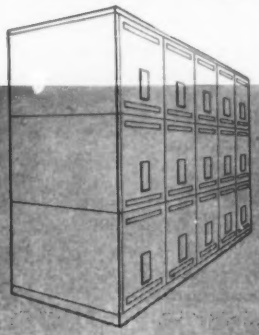
• WATER RECLAMATION

In a complex system of plant expansions, Hall Engineers are helping to work out (1) virtual elimination of costly city water, except for drinking; (2) reduction to minimum use of well water because of dropping water table; (3) clarification of river water for process use and cooling; (4) study of all process water for maximum re-use before discharge.

• DISPOSAL OF WASTE WATER

When state sanitary authorities objected to discharging plating waste into a stream, Hall Engineers recommended and helped to adapt ion-exchange to eliminate nuisance and aid recovery of metals in critically short supply.

To simplify switchgear problems...plan your

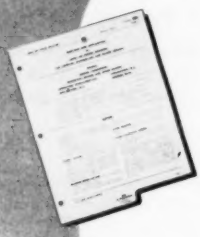


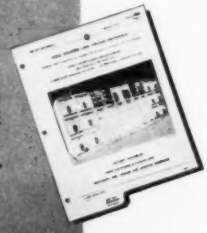
***BEFORE YOU SPECIFY*—SEND FOR YOUR FREE COPIES OF THIS INFORMATIVE I-T-E LITERATURE**

I-T-E Selection and Application Data is specially prepared by I-T-E application engineers to help you through the important steps in planning your switchgear system.

CATALOG SECTION 1003—Comprehensive, illustrated 50-page catalog contains complete data on selection and application of I-T-E low-voltage air circuit breakers and individually enclosed circuit breakers (Uralites).

CATALOG SECTIONS 1104, 1304, 1404, 1504—Detailed description of construction, operation, and application of I-T-E's KA, KB, KC, and LG circuit breakers—and I-T-E's full line of auxiliary and trip devices. Catalogs give you useful tables, wiring diagrams, mounting instructions, and dimensions.





CATALOG SECTION 6004—gives full information on I-T-E Multumite metal-enclosed, low-voltage switchgear. Completely describes I-T-E drawout construction and cubicle design. Contains useful specifications, dimensions, and suggestions for planning your metal enclosures.

FREE

I-T-E CIRCUIT BREAKER CO.
Switchgear Division, Dept. P
19th and Hamilton Sts.
Philadelphia 30, Pa.

Please send me the catalogs which I have checked:

- ☐ Catalog Section 1003
- ☐ Catalog Sections 1104, 1304, 1404, 1504
- ☐ Catalog Section 6004

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE____

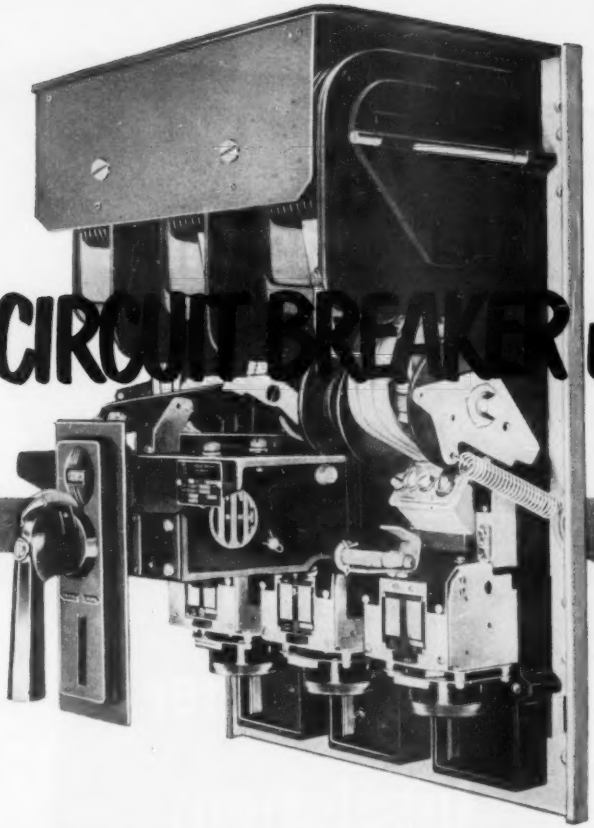
I-T-E

LOW-

I-T-E CIRCUIT

Canadian Mfg. & Sales:

layout from CIRCUIT BREAKER up



I-T-E CAN SUPPLY INDOOR AND OUTDOOR EQUIPMENT IN RATINGS:

15,000 to 100,000 amperes interrupting
600 volts a-c, 250 volts d-c
to 6,000 amperes continuous, a-c or d-c
to 10,000 amperes continuous, d-c only

Expansion or modernization of your electrical distribution system calls for detailed analysis. Before you can properly select your system and equipment, you must consider such important factors as load, power supply, circuits, *protection*, and *reliability*.

This means getting down to fundamentals. And, fundamentally, system reliability depends on *circuit breaker* protection. That's why it pays to think of your switchgear requirements *first of all* as circuit breaker applications.

Follow these three simple steps when planning your switchgear layout. You can then be sure that the circuit breakers you buy will provide the protection you need:

- **KNOW YOUR APPLICATIONS**—their load characteristics, protection requirements, need for continuity of service;
- **KNOW THE CIRCUIT BREAKER** features and functions that will satisfy all application requirements;
- **KNOW THE MANUFACTURER**—his ability to help you solve your problems and provide the best breakers for the job.

I-T-E experience and specialists are at your service. Your local I-T-E application engineer will gladly work with you on any switchgear problems. Get to know him. Give him a call—*today*.

VOLTAGE SWITCHGEAR

BREAKER COMPANY • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., N. Y. 17, N. Y.

Check the three big reasons why it pays to specify Eagle-Picher Insulation:

1.

2.

3.

Eagle-Picher "66" Insulating Cement— All-purpose, rust-inhibitive, super-adhesive insulating cement. Great coverage, extreme thermal efficiency with "Springy Ball" pellets which won't collapse after application. Easy trowel application over all kinds of surfaces. Efficient up to 1800 F... reclaimable where temperatures do not exceed 1200 F.

THE EAGLE-PICHER

Cost-cutting insulations of top thermal efficiency

Insulating Cements

Fireproofing Cements

Supertemp Block

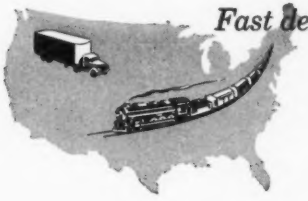
Blankets

Insulseal

Stalastic

Dependable contractors, trained to strict factory standards

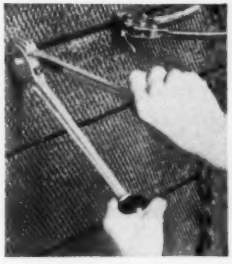
You can count on Eagle-Picher authorized contractors for uniformly high caliber service. Their qualifications provide assurance of a good job *every time* . . . efficient application of the Eagle-Picher insulation that best fits your needs.



Fast delivery from strategically located distribution points

The Eagle-Picher insulation line is stocked by distributors and authorized contractors coast to coast. The one nearest you will be happy to recommend insulating materials that give your equipment highest thermal efficiency . . . reduce fuel costs . . . help provide precise temperature control.

Eagle-Picher Supertemp Blocks—
A real insulating block—not a refractory! Unequalled for insulating quality. Weighs approximately 22-24 lbs. per cu. ft. Cuts easily with knife or saw . . . fits snugly over contoured surfaces. Monolithic structure . . . high refractory value. Withstands temperatures up to 1700 F. All standard sizes, from 3″ x 18″ to 12″ x 36″. . . in thicknesses from 1″ to 4″.



Eagle-Picher Mineral Wool Blankets—
Made under factory supervision, these blankets fill your needs for fast, convenient insulating of flat or curved surfaces on larger types of heated equipment. The wool is felted and secured by flexible metal fabric . . . possesses outstanding physical and chemical stability for maximum resistance to water, steam, corrosive fumes and vibration.

COMPANY EAGLE EP PICHER

General offices: Cincinnati (1), Ohio
Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

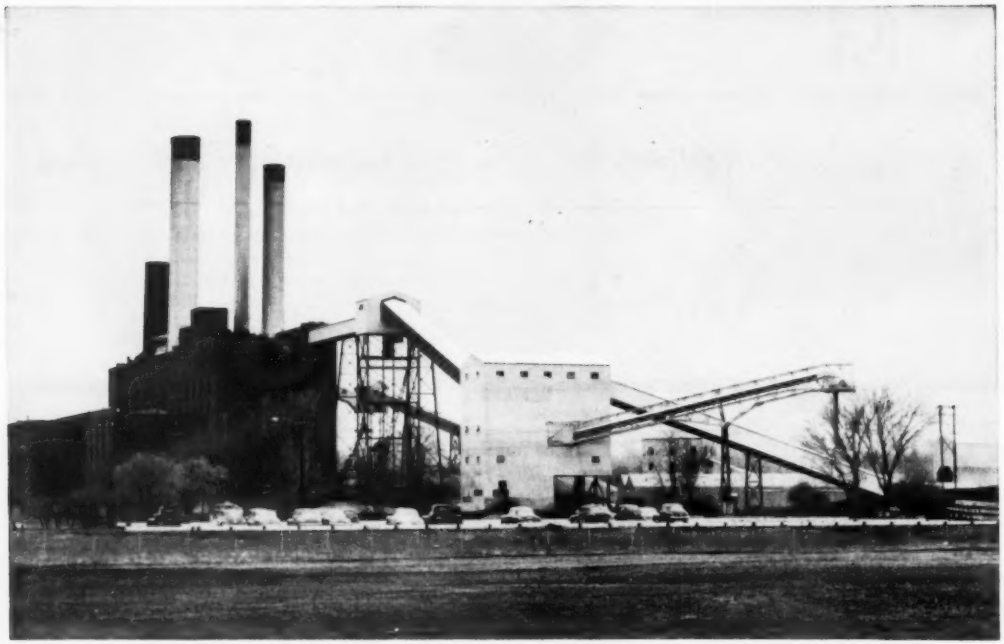
S-A CONVEYING Systems

prove **SUPERIOR** for **ECONOMICAL** Coal Handling Operations

COAL—mountains of coal—has been moved and is being moved speedily, efficiently and at lowest cost per ton by S-A equipment and installations! S-A engineers have the *know-how* to solve the most complex coal handling problems. And they draw upon a complete, time-proved line of bulk materials handling equipment which is demonstrating its superiorities all over the world. A few lines on your letterhead will bring information.

Belt Conveyors
REDLER Conveyor-Elevators
ZIPPER Conveyor-Elevators
Weigh Larries
Crushers, Roll & Ring Type
Bucket Elevators
Pivoted Bucket Carriers
Screw Conveyors
Skip Hoists
Belt, Pan & Plate Feeders
Track Hoppers & Bin Gates
TELLEVEL Bin Level Controls
Water Intake Screens
SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above.



The above public utility plant now has a complete S-A coal handling installation, modern to the Nth degree! A complete belt conveyor system moves coal from receiving to storage and reclaims from storage for direct delivery to the plant.

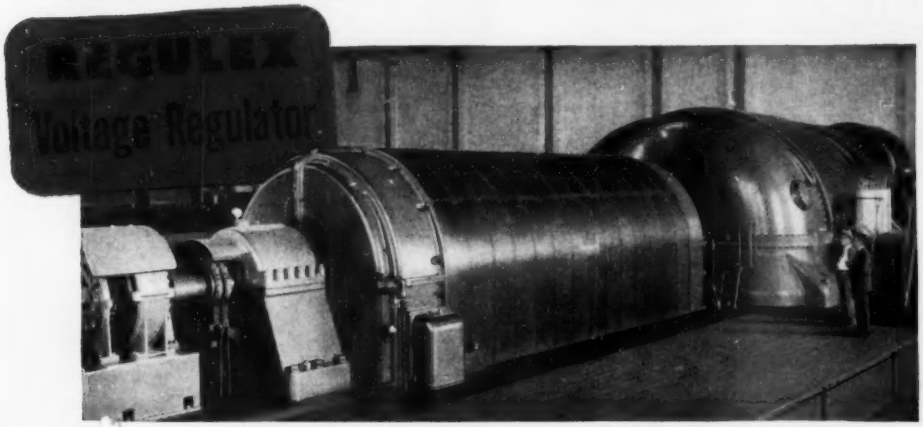
STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

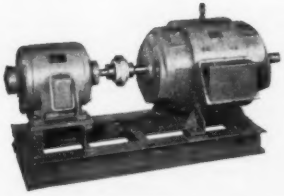
MEET NEW DEMANDS

ON OLD GENERATORS WITH

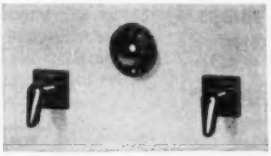


WHEN POWER DEMANDS GROW, increase your available generator capacity by increasing the safe operating limits. Install *Regulex* voltage regulators. They will automatically keep the field current high enough for stable operation — assure a safe minimum field current for any power factor load. The fast acting *Regulex* voltage regulator will also minimize the effect of system disturbances caused by sudden load changes or fault conditions.

Regulex Control is Accurate... Simple to Adjust and Maintain



THE MOTOR-DRIVEN *Regulex* exciter is conservatively rated for long life. Since it's similar in construction to a dc generator, the same periodic inspection routine can be followed. No special training of maintenance personnel is required.



ONLY THREE operating controls needed: (1) a control switch places regulator in and out of service; (2) a second switch controls the motor-operated main exciter field rheostat; (3) a voltage adjusting device selects proper ac regulated voltage.

COMPONENTS of the *Regulex* voltage regulator in this cabinet have no moving parts, require no maintenance or adjustment after installation. This single control cubicle can be placed in any convenient spot or combined with switchgear equipment.

★ You can use *Regulex* voltage regulators on alternators, synchronous condensers, and large synchronous motors. In every application, *Regulex* control gives fast response, provides accurate, sensitive voltage control. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

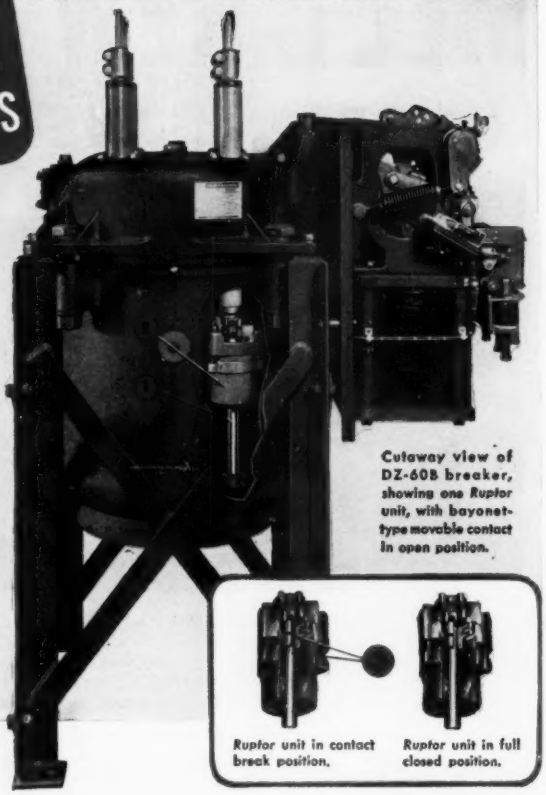
Regulex is an Allis-Chalmers trademark.

A-3770

ALLIS-CHALMERS

ALLIS-CHALMERS Type DZ Indoor Oil Circuit Breakers

CHECK THIS "Inside Story"



Cutaway view of DZ-60B breaker, showing one *Ruptor* unit, with bayonet-type movable contact in open position.

Ruptor unit in contact break position.

Ruptor unit in full closed position.

A LOOK INSIDE shows why years of dependable protection are assured with an Allis-Chalmers DZ breaker. Within the rugged frame and tank are time-proved *Ruptor* interrupting devices—which have their contacts controlled by a mechanically trip-free solenoid-operating mechanism. *Ruptor* units provide long periods of continuous, trouble-free service because they offer:

SIMPLE DESIGN: Bayonet contacts (1) are the only moving parts.

EASY INSPECTION: Drop the tank, and the bayonet contacts are visible in open position. For access to the stationary contacts, remove four bolts and cylindrical shell (2).

DEPENDABLE OPERATION: Tulip and bayonet type contacts (3) are self-aligning and self-cleaning; they maintain high conductivity without readjustment. Efficient interruption on special arcing-alloy contacts within oil-filled *Ruptor* unit minimizes arc energy—contributing to long contact life and low oil deterioration.

Ruptor is an Allis-Chalmers trademark.

Allis-Chalmers circuit breakers are available in ratings from 2.5 to 230 kv, with interrupting capacities from 15,000 to 10,000,000 kva, to meet all industrial and power company requirements. For more information, call your nearby A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3825

TYPE	RATED KV	MINIMUM KV AT RATED KVA	RATED AMPS	KVA INT. CAPACITY
DZ-40B*	7.2	2.3	600	100,000
			1200	100,000
			2000	100,000
DZ-60B†	13.8	4.0	600	150,000
			1200	150,000
DZ-100B†	13.8	4.0	1200	250,000
DZ-200B†	13.8	6.6	1200	500,000
			2000	500,000

*Ask for Bulletin 71B6179.
†Ask for Bulletin 71B6129.

ALLIS-CHALMERS

Electrical Protection *Depends* on Mechanical Perfection

American Blower . . . a time-honored name in air handling

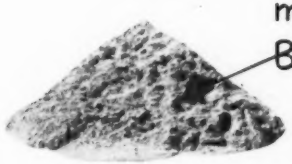
This is simple.
It filters the sludge
out of the oil
in your car.

BREECHING TO INDUCED DRAFT FAN
PRIMARY CONCENTRATOR
BREECHING FROM BOILER OR AIR HEATER
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

NOTE: ST Precipitators are also available for stoker-fired boilers with or without a secondary system.

This is simple.
It collects the fly ash
from a pulverized fuel-
fired boiler in your
power plant.

In this instance, too, a suprising amount of objectionable material is collected in a proved, practical manner. Investigate American Blower Type ST Precipitator, now!



AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary corporation

Serving home and industry

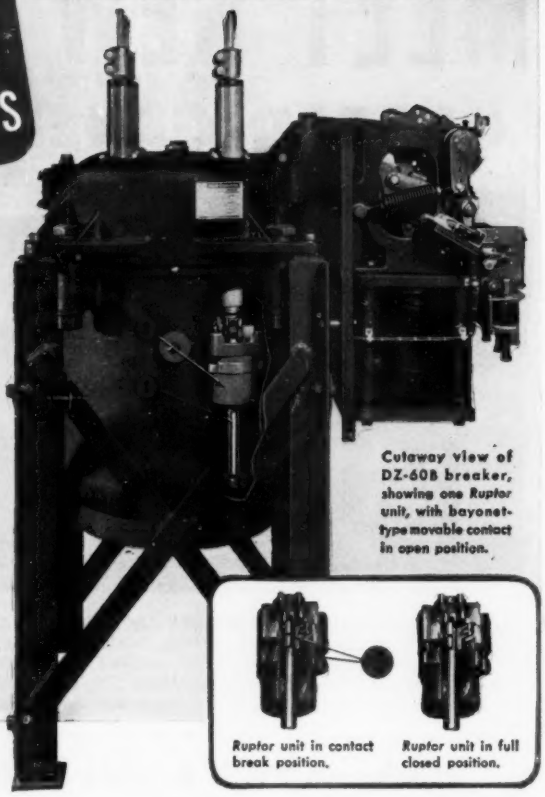
AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

ALLIS-CHALMERS

Type DZ Indoor

Oil Circuit Breakers

CHECK THIS "Inside Story"



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This is simple.
It filters the sludge
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BREECHING TO INDUCED DRAFT FAN
PRIMARY CONCENTRATOR
BREECHING FROM BOILER OR AIR HEATER
SECONDARY VENT FAN
SECONDARY SEPARATOR DISCHARGES THE FLY ASH TO AN AIR TIGHT RECEPTACLE OR SEALED ASH DISPOSAL SYSTEM

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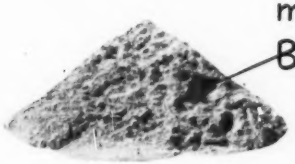

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Serving home and industry

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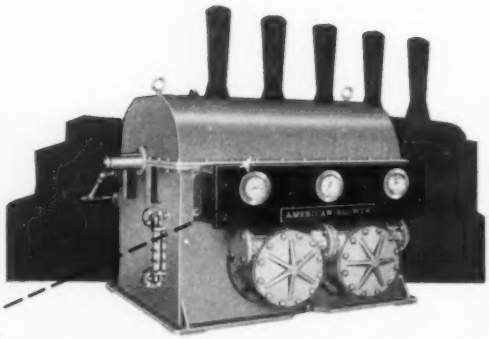
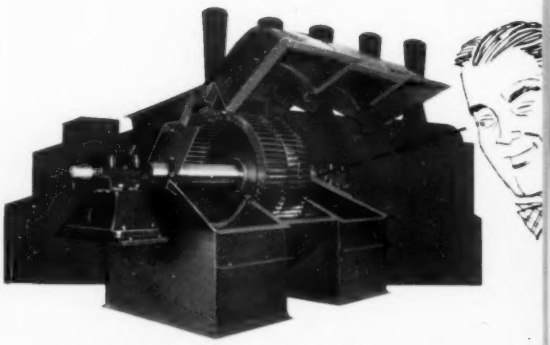
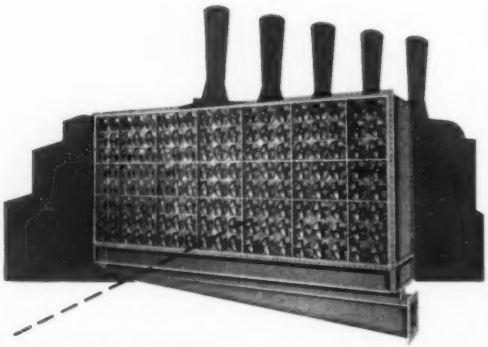
It all depends on how you look at it



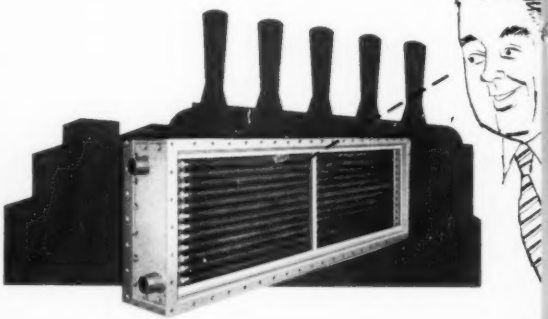
TO A CONTROL MAN this American Blower Class 6 Gyrol Fluid Drive, for flexible control of boiler feed pumps, looms up as big as this in relation to a power plant. He sees, too, American Blower Class 4 Fluid Drive for fan control.



TO A MECHANICAL DRAFT MAN a Sirocco Multi-Blade Fan, which delivers more gas per revolution than any other type, takes *this* proportion in the picture. He could see an American Blower HS Fan equally large if thinking of forced draft.



TO A FLY ASH EXPERT an American Blower Type ST Fly Ash Precipitator looks like this in relation to the rest of the power plant. Little wonder, for the Precipitator lifts a load off his shoulders and minimizes a nuisance.



TO A COIL MAN American Blower Heavy Duty Steam Coils would appear like this in his power plant picture. He likes their great strength, easy accessibility and the way they withstand the high pressures of heavy loads.

Looking at your complete power plant picture, we believe you'll find, as hundreds of others have, that all these American Blower Products improve over-all power-plant efficiency and insure years of dependable operation. Call our nearest Branch Office for complete data.

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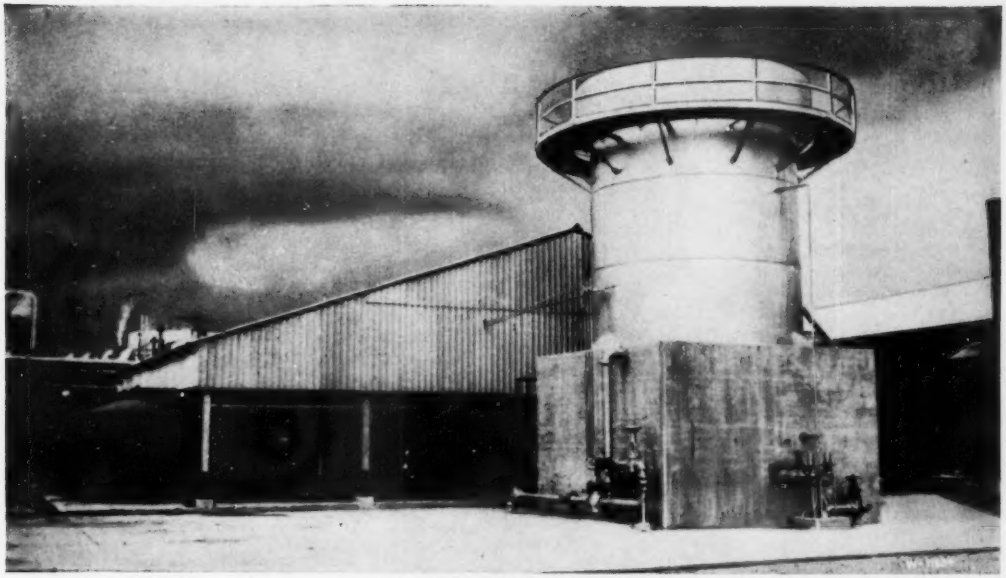


SPECIALLY DESIGNED 500 GPM WORTHINGTON TREATING SYSTEM at the new Pemex natural gas refinery in Poza Rica, Mexico. System includes cold-process slurry-type softener followed by acid feed, filtration and zeolite treatment. Engineered by Arthur G. McKee Company.

Specially Designed for Intermittent Service

Softening system for boiler feed water built for short-period operation, long shutdowns

Water conditioning requirements are especially tough at the new Pemex natural gas refinery in Poza Rica, Mexico.

Their need for variable-rate, continuous-service softener operation is complicated by the intermittent boiler feed-water storage demands.

Pemex's conditioning requirements have been met by a specially built Worthington system, so designed that the slurry bed is not lost during "off-service" periods. The bed resumes its normal suspended position at the instant service is resumed. This avoids the irregular treatment, delay and water waste common in systems that require creation of a new slurry bed after each shutdown period.

New Bulletin W-212-B5 gives you the vital facts about this unique cold process water softening method. Write for your free copy today.

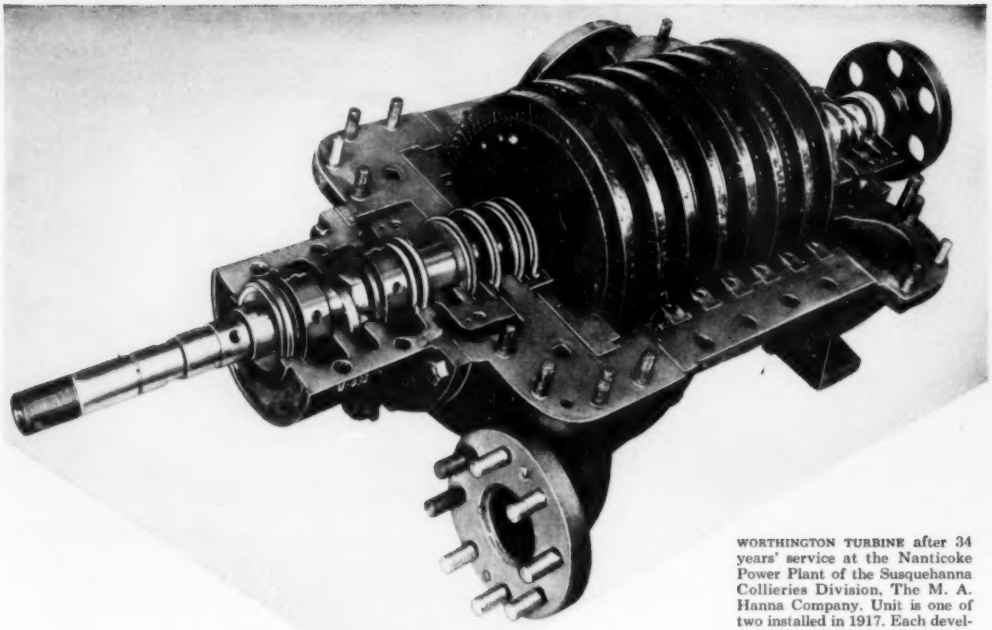
Worthington engineers and builds equipment for all the major types of water-conditioning systems, therefore is in an excellent position to give comprehensive and well-balanced recommendations on your water-conditioning equipment problems . . . further proof that *there's more worth in Worthington*. Worthington Corporation, Water Treating Section, Harrison, N. J.

J.1.3

Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON

Water Conditioning



WORTHINGTON TURBINE after 34 years' service at the Nanticoke Power Plant of the Susquehanna Collieries Division, The M. A. Hanna Company. Unit is one of two installed in 1917. Each develops 70 hp when operated on inlet steam of 125 psig and exhausting to atmospheric pressure.

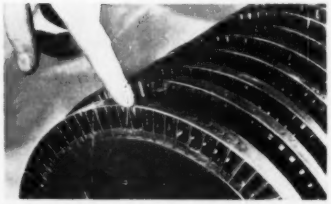
This reconditioned Worthington Turbine has seen 34 years' service

Installed in 1917, this Worthington steam turbine will probably go on to serve the Nanticoke Power Plant of the Susquehanna Collieries Division, The M. A. Hanna Company, for many years to come.

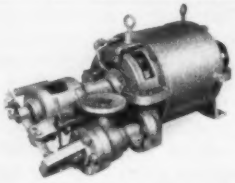
This unit is one of two that for 34 years have been driving induced draft fans—and was recently returned to Worthington's Wellsville, N. Y., plant for reconditioning.

Whether your requirements call for 70 hp or 24,000 hp, the complete Worthington line offers you the right steam turbine for your mechanical drives—a rugged performer that's ready to serve you economically and give you years of uninterrupted service.

Worthington Corporation, Steam Turbine Division, Wellsville, New York.



CLOSE-UP OF TURBINE BLADING shows that, except for a few single insertions, it remains the same as when turbine was installed 34 years ago.



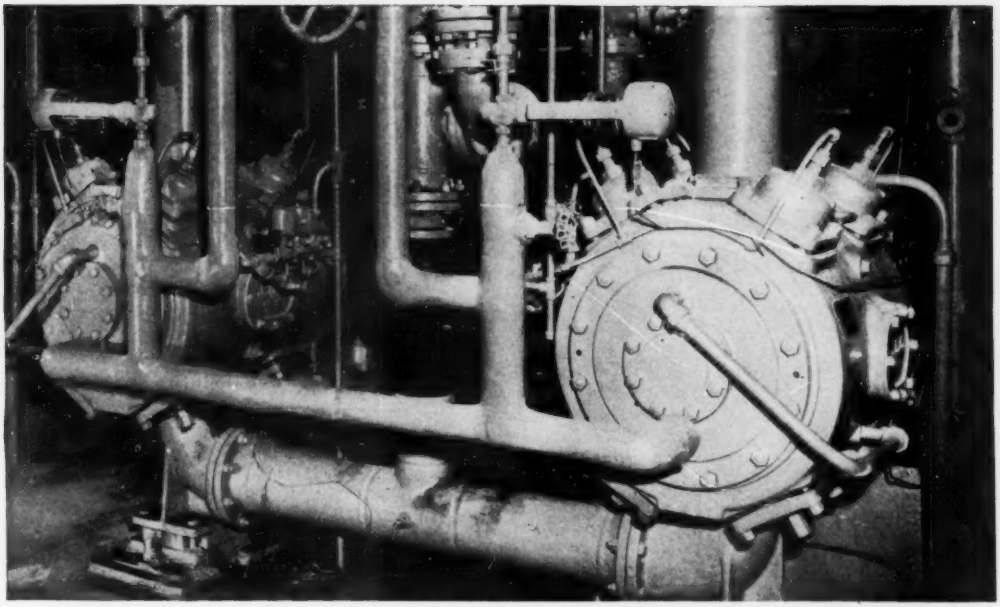
COMPLETE TURBINE—ONE OF THE TWO that have been driving fans for Susquehanna Collieries since 1917.

T-2-3

A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbines



CONTINUOUS OPERATION of this Worthington Type DC Horizontal Compressor helps keep aureomycin production up at Lederle Laboratories plant in Pearl River, N. Y.

Compressor operates continuously to help produce aureomycin

Installed for Lederle Laboratories in 1949, unit operates at 100% capacity day and night.

No rest periods for this compressor. When you're producing antibiotics like aureomycin, you just can't afford them!

The Lederle Laboratories Division of American Cyanamid Company anticipated rigorous operating requirements when they installed this Worthington horizontal compressor back in 1949.

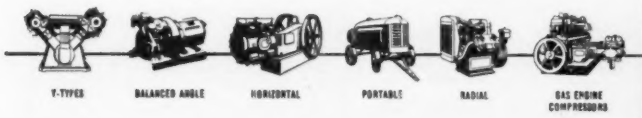
They wanted it to supply compressed air for use in the production of aureomycin—24 hours a day, seven days a week, at 100% capacity. The fact that the unit has operated since installation in 1949 with no attention other than routine maintenance is but "normal" for a sturdy Worthington compressor like this one.

This Type DC compressor has the exclusive Worthington Feather* Valve, Worthington's own automatic variable capacity control, and high efficiency Worthington intercooler—just some of the reasons why *there's more worth in Worthington.*

Remember Worthington's auxiliary equipment, too. Write to Worthington Corporation, Compressor Division, Buffalo, New York.

*Reg. U. S. Pat. Off.

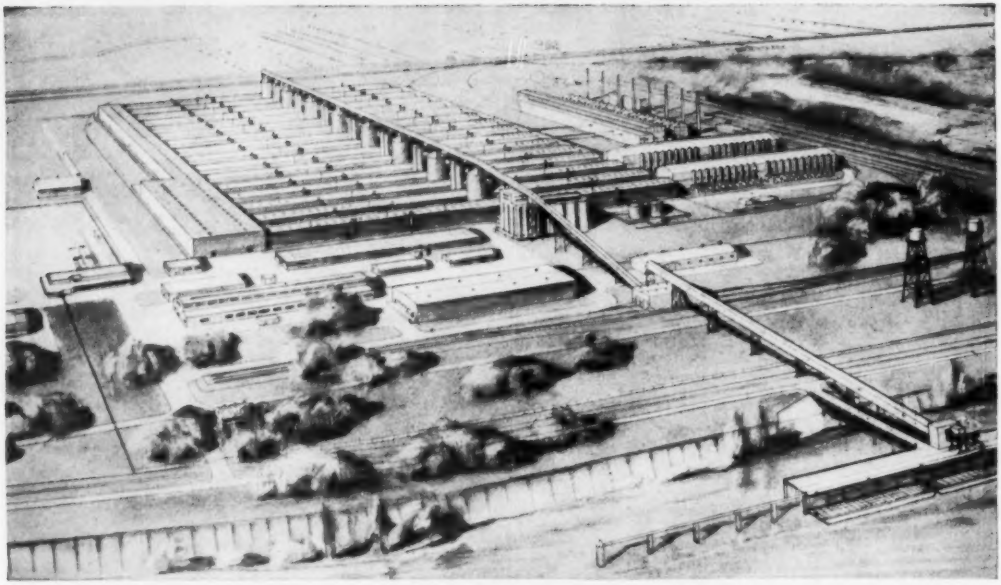
K.2.1



No Other Compressor Will Outperform a Worthington

WORTHINGTON

Compressors



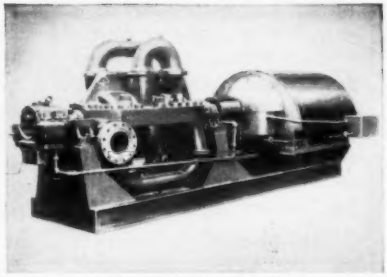
KAISER ALUMINUM AND CHEMICAL CORPORATION'S new 400,000,000 pound-a-year, $150,000,000 aluminum reduction plant at Chalmette, La., designed and built by Kaiser Engineers, is the largest plant of its kind in the U. S. The plant—where production began in December, 1951—uses 19 Worthington boiler-feed pumps and other Worthington equipment including thirty 9,300 square-foot condensers, and fifteen 250,000 pound-per-hour deaerators, 2 steam turbines and numerous circulating pumps.

Power plant at largest aluminum reduction plant to use Worthington pumps, condensers, deaerators

It takes plenty of electric power to produce 400,000,000 pounds of aluminum in a year. And that's what they're doing at the new Kaiser Aluminum plant at Chalmette, La.—largest aluminum reduction plant in the U. S.

Kaiser joins many other top companies in choosing Worthington boiler-feed pumps as well as other key equipment for their new plant. Such choices arise out of an insistence for equipment that's engineered for maximum performance.

Worthington engineering produces boiler-feed pumps of the most advanced design in the field, made from specially selected metals. Each pump is exactly *right* for the pressure and temperature with which it is to perform. Over 110 years of Worthington experience in building pumping equipment go into making this a certainty. Worthington Corporation, formerly Worthington Pump & Machinery Corporation, Centrifugal Pump Division, Harrison, New Jersey. C.2.4

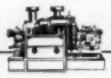


19 WORTHINGTON 250,000 LBS PER HR BOILER-FEED PUMPS at new Kaiser plant, handle feedwater at 257 F against a discharge pressure of 1,030 psig. Pumps are axial-balanced, volute type centrifugals. Two, similar to one illustrated, are driven by Worthington 450-hp steam turbines.

For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.

For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.

For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.

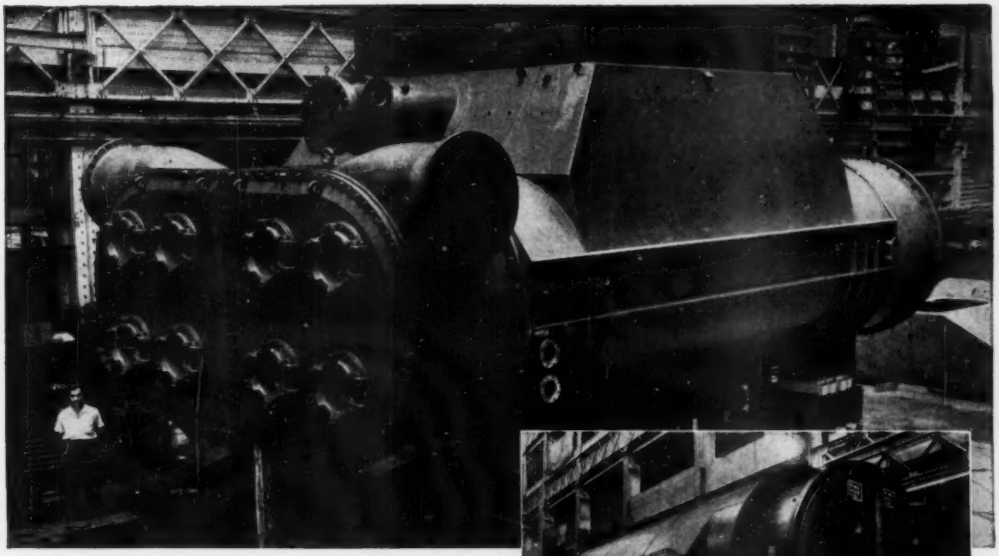


For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

The World's Broadest Line Assures You the Right Pump for Every Job

WORTHINGTON

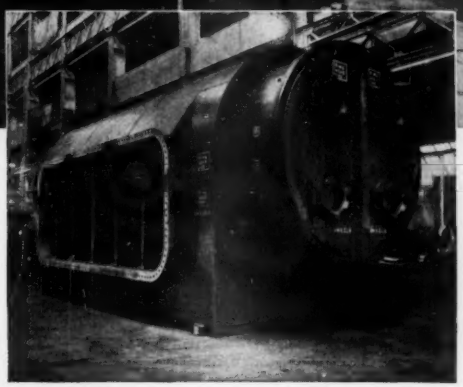
Centrifugal Pumps



LOW-HEADROOM, OVAL-TYPE CONDENSER (with extraction heater in exhaust neck), is typical of several furnished in sizes ranging from 27,500 to 80,000 sq. ft.

"TAILORED TO FIT"

Low-headroom design for condensers typical of Worthington "space" engineering



SIDE INLET CONDENSER, one-half of several "twin shell" units serving turbine-generators of 20,000 to 100,000 kw

It all began in 1854.

That was the year the first Worthington condenser was installed. From that time, up through the early twentieth-century "evolutionary" period in condenser design, Worthington has constantly kept in step with prime mover and steam power plant development. Today, engineers must design and build condensers within the limitations imposed by high construction costs.

Thanks to the flexible nature of the Worthington "Double Folded Tube Layer", today's "low-headroom" requirements are easily met without any sacrifice in efficiency. For single-shell, beneath-turbine installations, the rectangular box-type (built by Worthington as early as 1904) has given way to the modern "oval" design illustrated above. Other designs include single-shell, side-mounted units with exhaust elbows, and twin shells with horizontal or "T" shaped exhaust connections, popular for outdoor or semi-outdoor plants.

As the capacity of turbine-generators increases, so does the demand for larger condensers. This places more importance on "space" engineering. Worthington—with over a century of experience in the manufacture of steam power equipment—is prepared to build efficient condensers in all sizes to suit any reasonable limitations. (Now under construction for an eastern utility is the largest single-shell unit ever ordered—125,000 sq. ft.)

Write for advice on your new installation, stating requirements. Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, N. J.

Z.2.1

WORTHINGTON

Condensers

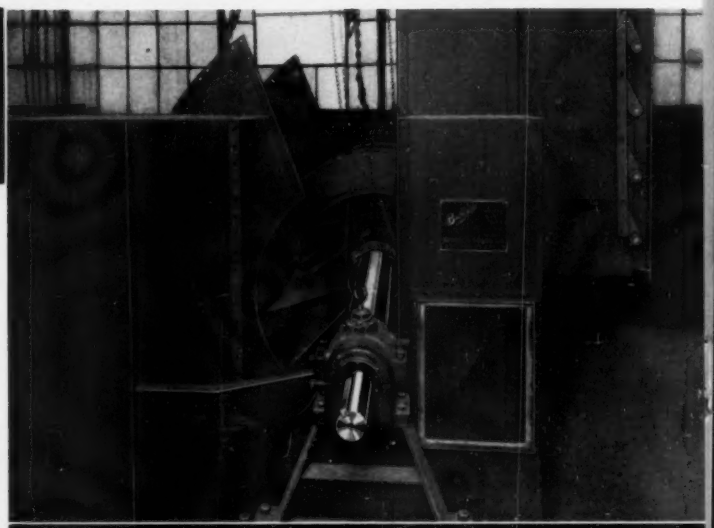
A GREAT TEAM IN STEAM

"Buffalo"

Tips on Getting Best Results With FANS

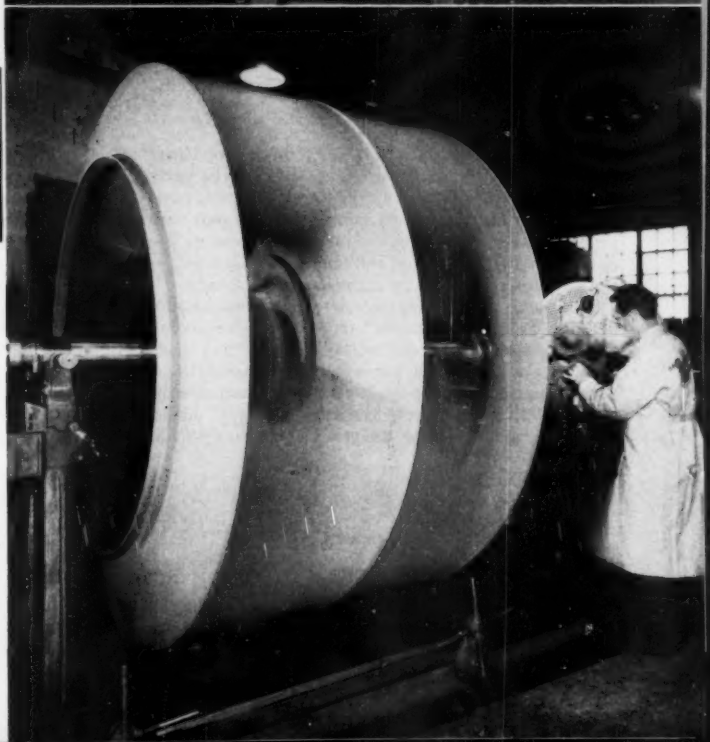
WHAT TO LOOK FOR IN CHOOSING AN INDUCED DRAFT FAN

RUGGED, ACCESSIBLE HOUSING CONSTRUCTION

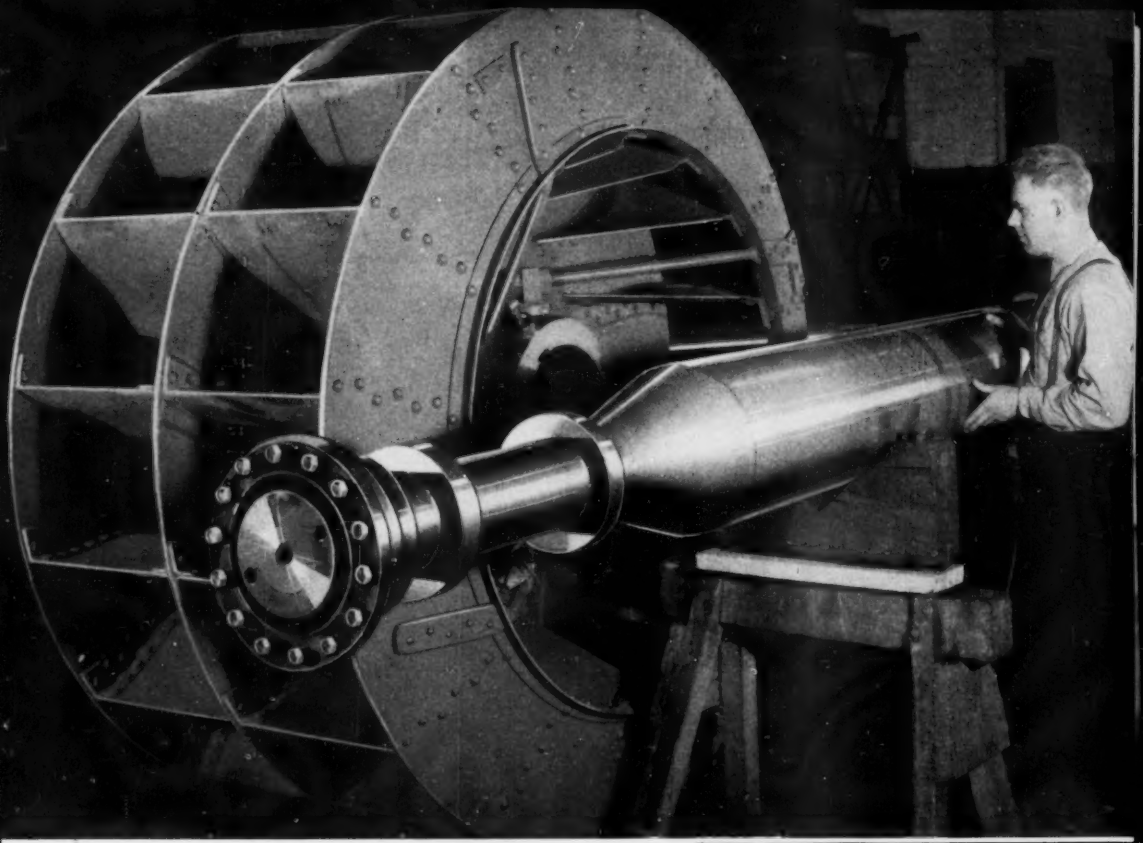


Heavy steel plate, built with removable sections that are easy to handle, makes for ideal induced draft fan housings. The photo, right, of a "Buffalo" Induced Draft Fan, shows convenience of assembly or dismantling. Note sturdy, construction for long wear. Inlet vanes increase efficiency and minimize erosion.

EXTRA HEAVY ROTORS DYNAMICALLY BALANCED



An unbalanced rotor means vibration. With heavy induced draft rotors, this can be destructive to shafts and bearings. All "Buffalo" wheels are balanced at the factory by precision equipment shown at right, ready for smooth operation. For additional information on selection of a draft fan, write for BULLETIN 3750.

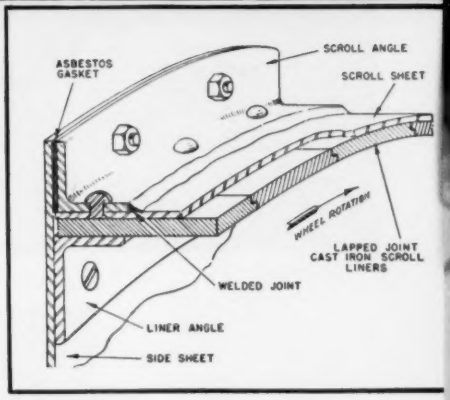


ADEQUATE SHAFTS, COUPLINGS, BEARINGS

The above forged steel shaft shows oversize construction in "Buffalo" Fans. Note thrust collars turned out of solid shaft material. Flexible "Buffalo" couplings have rubber bushings and allow for lateral motion. "Buffalo" bearings have large oil reservoirs, large bearing surface, babbitted and lubricated thrust shoulders, are water cooled when necessary.

PROTECTION AGAINST HEAT AND EROSION

Induced draft fans must resist constant heat and storms of erosive fly-ash. Diagram, at right, shows detail of removable scroll liners provided for handling dust-laden air or fly-ash. Rotors may be provided with welded-on wearing strips to further lengthen the life of the already heavy-gauge blades.



DIAMOND JUBILEE 75TH ANNIVERSARY

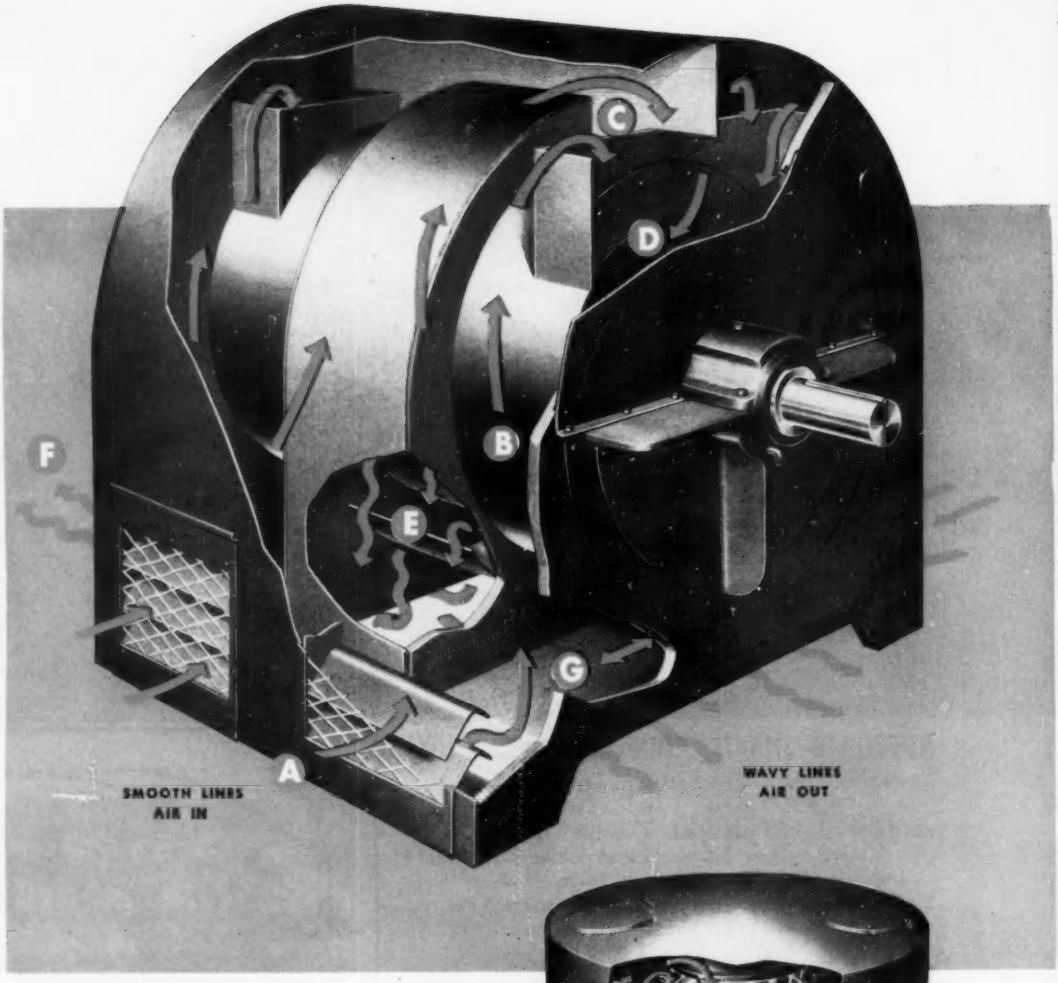
BUFFALO "Buffalo" FORGE COMPANY

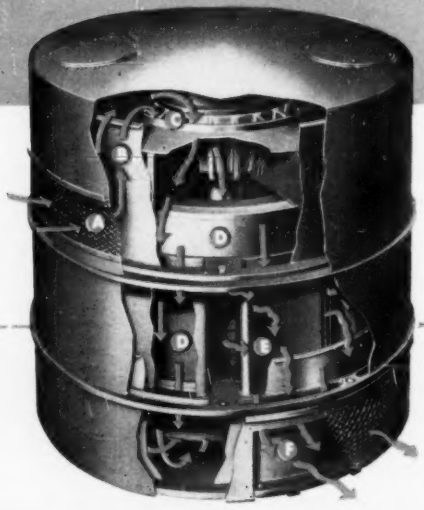
488 Broadway Buffalo, New York

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

"Buffalo" INDUCED DRAFT FANS





VERTICAL OUTDOOR MOTOR

New Outdoor Motor

dares weather to do its worst!

You can install these induction motors outside—any place—and forget the weather. They're naturals for power station auxiliary service, in fact, any place where a motor must stand up to weather—wind, rain, or hail as long as the ventilated openings are unobstructed.

Look at the cutaway drawing at the left. You can see that the motor is completely enclosed by a steel shell. Note how air enters the shell at the bottom (A), flows up and around in the motor shell (B), to top (C), where it is drawn down and into the interior of the motor (D). Warm air is discharged from motor (E) and out enclosure ends (F).

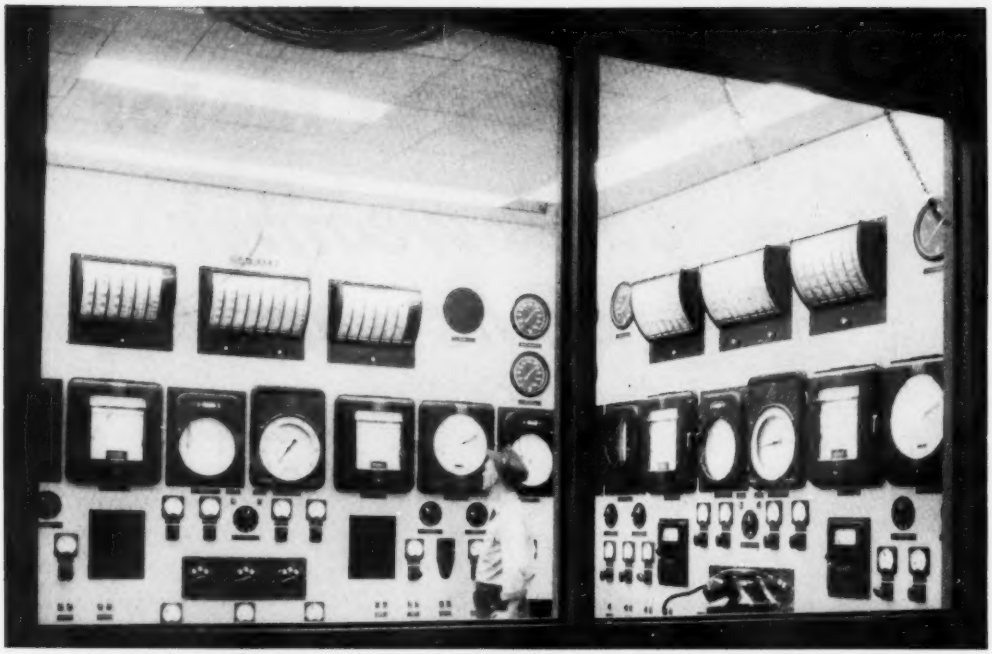
Now, what happens when moisture, rain and sleet are present in the air? The air is drawn in at point (A). As the air rises at a slow velocity, water, sand and other heavier-than-air particles fall to base (G) where a drain carries them away. Result? Regardless of outside conditions, only clean dry air enters the motor.

Remember, too, this motor includes features that have made Westinghouse Induction Motors leaders in industry. For example: Sectional covers and air shields, easily removed by hand. Split bearing housings, with bearings readily accessible for inspection or replacement. Sturdy welded steel frame; stronger, lighter, smaller.

Also, vertical-type outdoor motors are available with features that have made Westinghouse motors leaders in industry.

Get the facts now for immediate use or with an eye toward future requirements. See your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10375

YOU CAN BE SURE...IF IT'S
Westinghouse
LARGE INDUCTION MOTORS



AIR CONDITIONED CONTROL ROOM ILLUSTRATES COMPLETE BOILER PLANT INSTRUMENTATION SUPPLIED BY HAYS.

MULTIPLE FUEL COMBUSTION CONTROL OF CYCLONE FURNACES

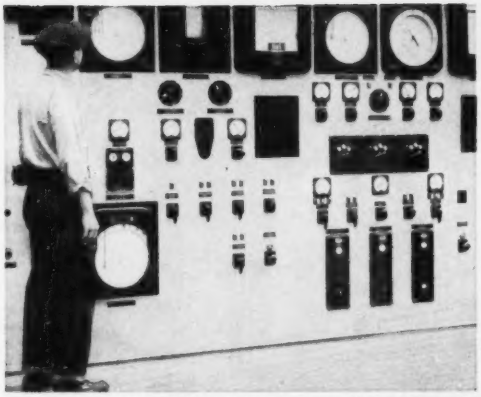
At Michigan City Station of Northern Indiana Public Service Co.*

Flexible, efficient, safe firing of *both* coal and gas in cyclone furnaces is being achieved at the Michigan City, Indiana generating station of NIPSCO* by means of an electric combustion control system designed and built by engineers of The Hays Corporation working closely with company officials and the consulting engineers, Sargent & Lundy.

The system permits any desired allocation of load among the three boilers, between the two cyclone furnaces of a given boiler and between the two fuels being burned simultaneously in a given cyclone. Thus, any conceivable load-need or fuel supply situation can be accommodated.

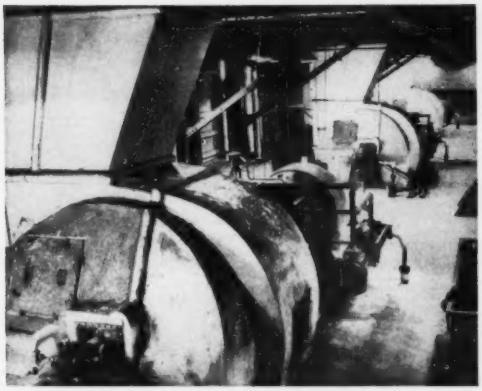
In addition, complete safety for the multi-million dollar installation is "built in" since each boiler is equipped with a system of mechanically and electrically interlocked selector switches arranged to require a definite sequence of operation in transferring from manual to automatic control and vice versa. For example, interlocks require that (1) the ID fan must be running (2) the ID fan damper must be partially open and (3) at least one of the FD fan duct dampers must be opened before the FD fan can be started.

This installation illustrates the care and ingenuity exercised by Hays engineers in solving the combustion control problems of boiler plant operators throughout the world—regardless of boiler size, fuels being burned, etc. Write for a free, fully illustrated, 8-page story on this central station—available from The Hays Corp., Michigan City, Indiana.

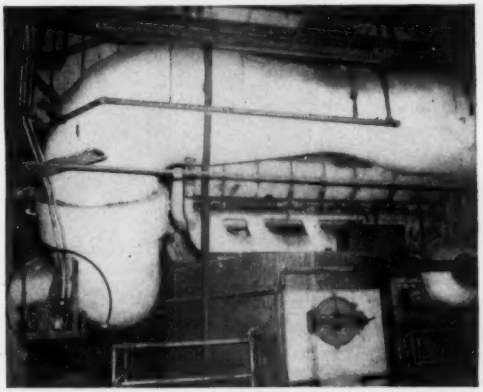


SPACE SAVING is achieved by mounting all position indicators, manual control stations, fuel-air ratio adjustments, and mechanical interlocks for one boiler inside control room

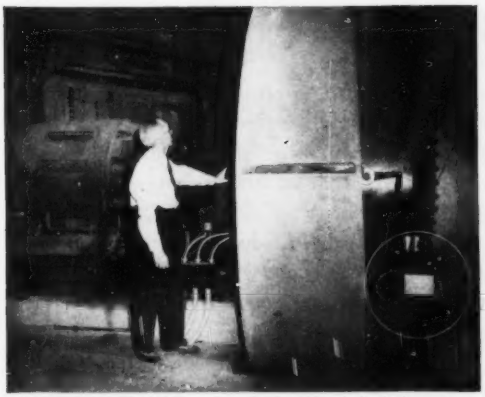
near related instruments for convenience of operator (*at left*); controllers themselves are grouped on outside wall of control room for ease of inspection and maintenance (*at right*).



CORRECT FURNACE DRAFT is maintained by controlling induced draft fan inlet damper as well as induced draft fan speed. Latter is accomplished by means of hydraulic coupling equipped with reversing oil pump.



HUGE VENTURI in forced draft duct provides means of accurately measuring air to individual cyclone. The Hays power unit *(indicated within circle)* operates a damper in this forced draft duct.



THREE 120,000 CFM, motor driven forced draft fans (one for each boiler) provide air for cyclones at 54" water pressure. Hays power unit (*circle*) adjusts forced draft fan inlet damper in response to forced draft duct pressure controller.

Automatic Combustion Control
Boiler Panels • Hays-Penn Flowmeters
Venturi Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets • CO_2 Recorders
Electronic Oxygen Recorders

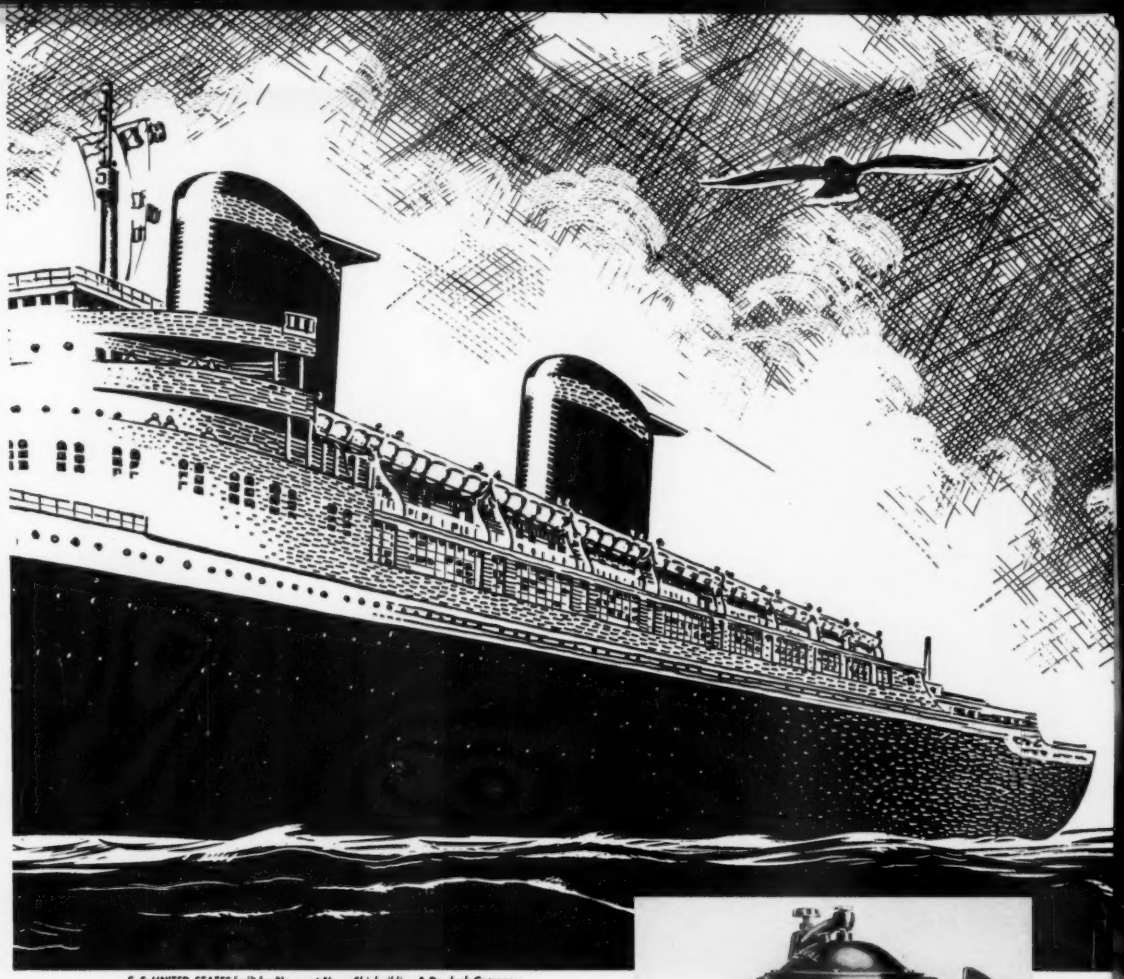
THE hays CORPORATION

MICHIGAN CITY, 3 INDIANA

PROTECTED BY DE LAVAL OIL PURIFIERS

De Laval Oil Purifiers protect the main turbines of America's largest ship. Other De Laval centrifuges are installed on the S.S. "United States" for diesel fuel oil service. They insure that the oil for the diesel engines, driving auxiliaries, reaches injection nozzles clean and dry, hence in a condition to provide maximum BTU rating.

Wherever De Laval centrifuges are installed, whether in marine service or in some power plant ashore, they always do one basic job best—they protect the power unit by removing from lubricant or fuel both the undesirable solid impurities and all water. In all cases, De Laval machines are the best means obtainable for insuring against the troubles that wet or dirty oil can cause.

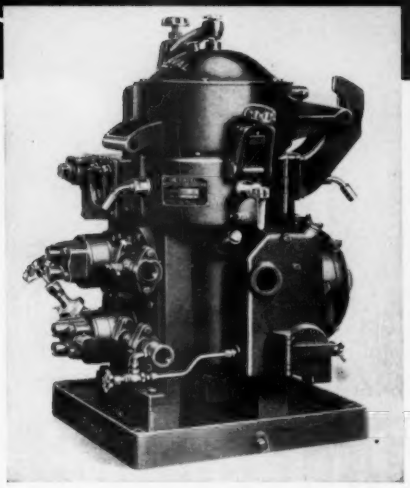


S. S. UNITED STATES built by Newport News Shipbuilding & Drydock Company

DE LAVAL

LUBRICATING AND FUEL OIL PURIFIERS

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO. 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited Peterborough, Ont.



De Laval "Uni-Matic" Oil Purifier

LIMITORQUE

puts Valve Operation in the hands of Key Workers

Valves of all types up to 120" diameter can be opened and closed easily and quickly with LimiTorque. Conveniently located push button stations are the control centers from which remotely located valves, or those in high or hazardous locations may be operated by highly responsible employees. It is unnecessary to entrust important valve operations and valuable equipment to men chosen for brawn alone. Indicating lights show at a glance the exact position of each valve.

Because of its adjustable valve seating feature, LimiTorque will prevent damage to valve parts due to overload. LimiTorque may be actuated by any available power source such as electricity, water, gas, oil or air. Your valve maker can supply LimiTorque.

LIMITORQUE CONTROL

OUR 60TH ANNIVERSARY

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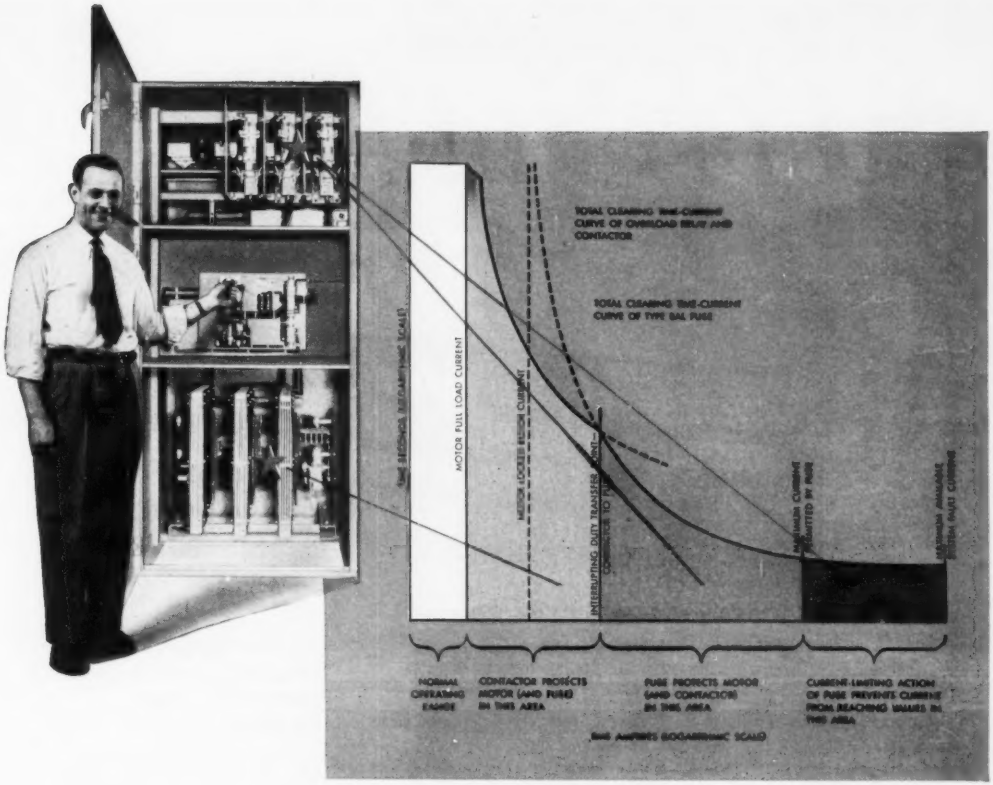
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls


TOTAL CLEARING TIME-CURRENT CURVE OF OVERLOAD RELAY AND CONTACTOR
TOTAL CLEARING TIME-CURRENT CURVE OF TYPE BAL FUSE
MOTOR FULL LOAD CURRENT
MOTOR LOCKED ROTOR CURRENT
INTERRUPTING DUTY TRANSFER POINT—CONTACTOR TO FUSE
MAXIMUM CURRENT PERMITTED BY FUSE
MAXIMUM ASYMMETRICAL RMS FAULT CURRENT
NORMAL OPERATING RANGE
CONTACTOR PROTECTS MOTOR (AND FUSE) IN THIS AREA
FUSE PROTECTS MOTOR (AND CONTACTOR) IN THIS AREA
CURRENT-LIMITING ACTION OF FUSE PREVENTS CURRENT FROM REACHING VALUES IN THIS AREA

This co-ordinated protection safeguards men, motors and circuits

Men? Motors? Circuits? Which can be ignored at a high-voltage motor installation? Obviously, NONE. Yet, high-voltage protective equipment is often installed that DOES NOT safeguard all three.

Protection must be co-ordinated to be complete. It must safeguard all elements under all conditions. Examine the above chart and note how a Westinghouse High-Voltage Combination Starter co-ordinates fuses and contactor to provide continuous protection for both motors and circuits. Note how the sectionalized steel cabinet protects personnel and equipment.

Co-ordinated protection also safeguards production. No chance for high current faults to bypass the starter and damage equipment. Down time is confined to correcting the fault and then reclosing the circuit.

The advantages of Westinghouse Co-ordinated Protection are many. Talk them over with your Westinghouse representative. Or, write for booklet B-4673 "High-Voltage Motor Starters". Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-27029

YOU CAN BE SURE... IF IT'S
Westinghouse
HIGH VOLTAGE STARTERS

These Industrial of Detroit

OF VARIOUS TYPES AND CAPACITIES ARE TYPICAL OF THOUSANDS OF CUSTOMERS. SUCH UNIVERSAL ACCEPTANCE . . . AND THE LARGE NUMBER OF REPEAT ORDERS . . . ARE OVERWHELMING EVIDENCE OF SATISFACTION.

Aluminum Co. of America—9 plants
Allied Chemical & Dye Corp.—4 plants
Abitibi Power & Paper Co. Ltd.—2 plants
Amalgamated Sugar Co.—3 plants
American Crystal Sugar Co.—3 plants
American Steel Foundries
American Tobacco Co.—2 plants
Armour & Co.—4 plants
The Borden Co.—28 plants
Burroughs Adding Mach. Co.—2 plants
Cannon Mills Inc.—10 plants
The Carborundum Co.—3 plants
J. I. Case Co.—5 plants
Chesapeake & Ohio Ry. Co.—7 plants
C. B. & Q. R. R. Co.—4 plants
Chicago & Northwestern R. R.—3 plants
Chrysler Corporation—12 plants
Columbian Carbon Co.—3 plants
Peter Cooper Corporations—4 plants
Crane Co.
Avco Mfg. Corp.
Crosley Division—2 plants
Crosse & Blackwell Co.—2 plants
Crucible Steel Co. of America—2 plants
Cudahy Bros. Co.
Deere & Co.—6 plants
E. I. Dupont de Nemours & Co.—9 plants
The Electric Autolite Co.—14 plants
The Falk Corp.
Firestone Tire & Rubber Co.—6 plants
General Electric Co.—6 plants
General Foods Corp.—3 plants
General Motors Corporation—37 plants
Goodyear Tire & Rubber Co.
Great Lakes Sugar Co.—3 plants
Great Western Sugar Co.—3 plants
Hercules Powder Co.—4 plants
Homestake Mining Co.—9 plants
International Harvester Co.—2 plants
International Shoe Co.—17 plants
Jones & Laughlin Steel Corp.
Spencer Kellog & Sons Inc.—6 plants
Koppers Co. Inc.—2 plants
Lever Bros. Ltd.
Libby, McNeill & Libby—3 plants
Libbey-Owens-Ford Glass Co.—3 plants
Liggett & Meyers Tobacco Co.—2 plants
Eli Lilly & Co.—2 plants
Marshall Field & Co.—3 plants
Michigan Sugar Co.—6 plants
Minnesota Mining & Mfg. Co.—4 plants
Minneapolis-Moline Co.—2 plants
Monsanto Chemical Co.—3 plants
Nash-Kelvinator Corp.—2 plants
National Dairy Prod. Corp.—12 plants
Nestle Co., Inc.—4 plants
New York Central System—14 plants
Pacific Mills—3 plants
Pittsburgh Plate Glass Co.—3 plants
Pullman Inc.—5 plants

WHY NOT LET US REDUCE YOUR STEAM COST?

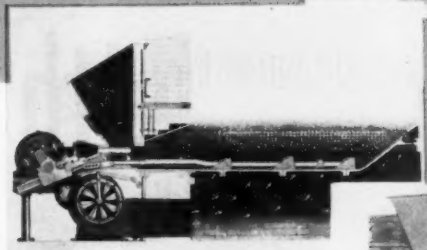
An informal discussion with one of our Engineers will cost you nothing and might save you a lot. Write us today.

DETROIT SINCE 1898 STOKERS

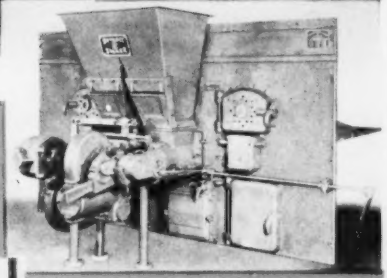
Users Stokers

THERE IS A TYPE AND SIZE OF DETROIT STOKER FOR EVERY INDUSTRIAL NEED

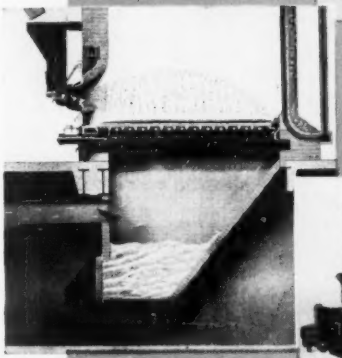
***LOSTOKER**—Single retort underfeed, with Adjustable Feed—great coal saver for small boilers.* ▶



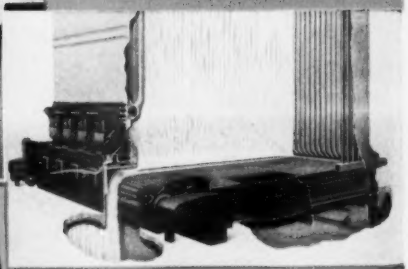
◀ ***UNISTOKER** with Adjustable Feed. Compact unit type. Fan and motor, conveniently mounted at front. Automatically controlled.*



***DOUBLE RETORT STOKER**—A Multiple retort, side cleaning stoker with Adjustable coal feed control.* ▶



◀ ***ROTOSTOKER**—Spreader stoker with overthrow rotors—Burns wide range of fuel—Handles fluctuating loads—Dumping, or stationary grate types.*



***ROTOGRATE STOKER**—Improved spreader stoker with grates that continuously discharge the ash at the front—Permits high burning rates per square foot of grates.*

Quaker Oats Co.
Ralston Purina Co.—11 plants
Republic Steel Corp.—2 plants
Rochester & Pittsburgh Coal Co.
Shepard Niles Crane & Hoist Corp.
Square D Co.
Stromberg-Carlson Co.
The Studebaker Corp.—3 plants
Swift & Co.—18 plants
Tennessee Coal, Iron & R. R. Co.
Tennessee Eastman Co.
Union Carbide & Carbon—3 plants
United States Gypsum Co.—4 plants
United States Leather Co.—5 plants
Walworth Co.—2 plants
W. Va. Pulp & Paper Co.—2 plants
Western Electric Co. Inc.
Wilson & Co.—8 plants
Worthington Pump—2 plants
Rudolph Wurlitzer Co.—2 plants
Wyman Gordon Co.
Willys-Overland Motors, Inc.

Automotive Manufacturing—
112 plants

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

Works at Monroe, Mich. • District Offices in Principal Cities

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Aircraft
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Explosives
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Electric Power
Food Products
Foundries
Gas Works
Gelatine
Glass
Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
Oil Refining
Paint
Paper
Public Utilities
Radio
Railways
Refrigeration
Rubber
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Sewage Plants
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Sugar
Textile
Tobacco
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Industry Leaders Set the Pace with VU

Right down the line, in most every industry, you'll find the leading companies — as well as the smaller companies that may well be tomorrow's leaders — depending on C-E Vertical-Unit Boilers for dependable, low-cost steam.

Take Pulp and Paper Mills for example. Few industries use more steam or have a larger stake in the economy and reliability of their steam generating equipment. The list on the opposite page is just a small sample of the nationally-known leaders in the pulp and paper field that have Vertical-Unit Boilers in service at one or more mills.

Only larger companies are listed because here, as in any industry, the buying decisions of big companies are especially significant. Such companies have the breadth of experience, the diversified operating conditions and the organization necessary to explore and evaluate the merits of the equipment they need.

So, where you need boilers — in capacities from 10,000 to 350,000 pounds of steam per hour — take a tip from the leaders. Discover — as they have — the advanced design . . . sound construction . . . proved reliability of C-E Vertical-Unit Boilers.

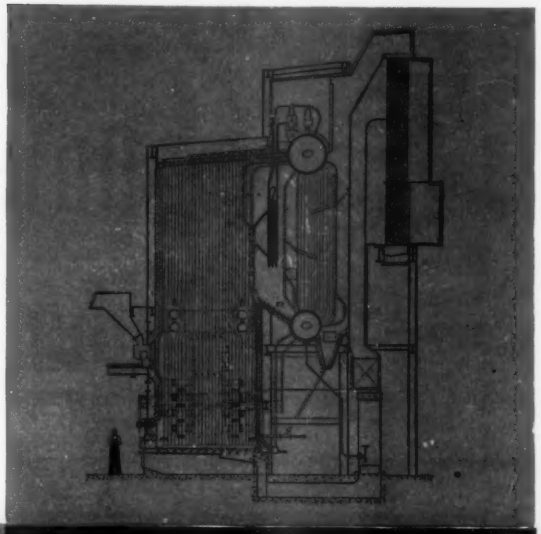
COMBUSTION ENGINEERING

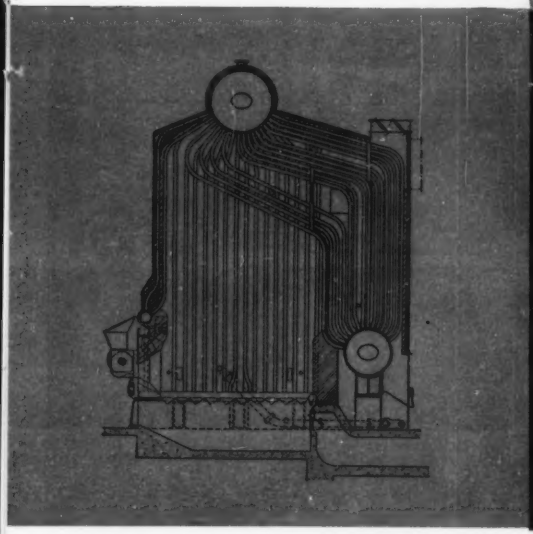
ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Leading Pulp and Paper Mills that have Purchased VU Units for One or more Plants

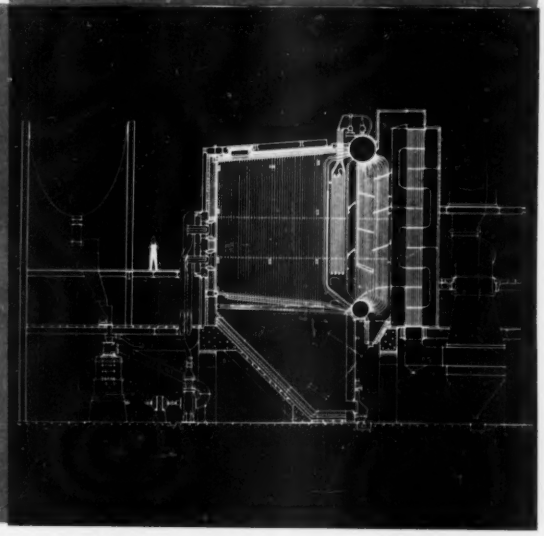
The Brown Company
Chesapeake Corporation
Container Corp. of America
Fraser Companies, Ltd.
Robert Gair Company, Inc.
International Paper Company
Kimberly-Clark Corporation
Macon Kraft Corporation
Marathon Paper Mills of Canada, Ltd.
National Container Corporation
St. Regis Paper Company
Scott Paper Company
S. D. Warren Company
Weyerhauser Timber Company

VU-50 Boiler — This unit, one of two duplicates, is installed at a West Coast mill. It is designed to burn hogged wood on a high-set spreader stoker. Capacity — 150,000 lb of steam per hr; operating pressure — 570 psi; steam temperature 675 F.





VU-10 Boiler, one of two in a Midwestern plant. Fired by coal, using a C-E Spreader Stoker. Capacity — 18,000 lb of steam per hr at 200 psi; no superheat. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr.



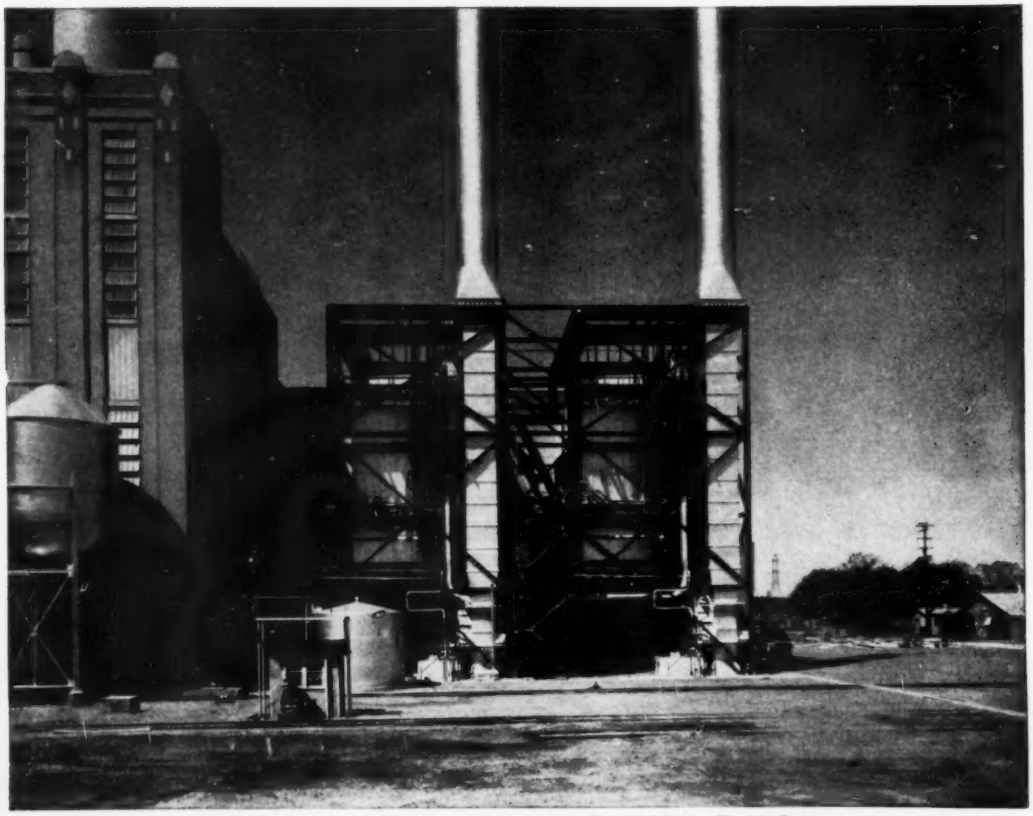
VU-50 Boiler installed in a Southern mill. This boiler is fired with pulverized coal using C-E Raymond Bowl Mills. The capacity is 150,000 lb of steam per hr. Steam pressure is 865 psi — steam temperature is 825 F.

B-612

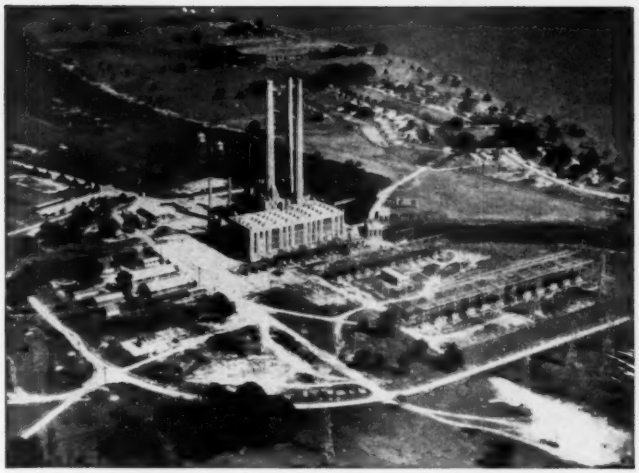
— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

Two Outdoor Boilers Under Automatic



Outdoor Installation of Two Large Boilers at the Trinidad Steam Electric Station.



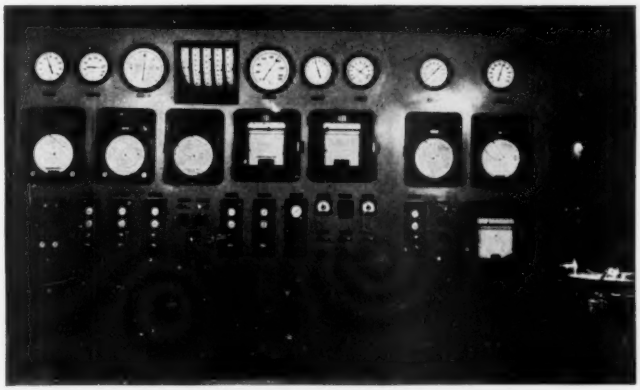
Aerial View of Trinidad Steam Electric Station. (Note the Two Outdoor Boilers Installed Behind the Main Building).

Control

at TRINIDAD STEAM ELECTRIC STATION • Texas Power & Light Company

● A most important part of the Texas Power and Light Company expansion program at their Trinidad Steam Electric Station, is this outdoor installation of two new gas fired, 350,000 lb. per hr. boilers. These boilers, operating at 920 psig., provide 70,000 KW additional capacity to meet the increasing power demand on the Trinidad Station. To achieve maximum efficiency and performance, the boilers were put under completely automatic control.

The AUTOMATIC COMBUSTION CONTROL system and the PRESSURE REDUCING AND DESUPERHEATING STATION were supplied by REPUBLIC FLOW METERS CO.



One Section of the Boiler Control Panels.

A Potent Tool for Cutting Costs

A properly engineered automatic control system is an effective way to cut power costs. Best of all, what automatic control is doing for the large plants such as the Trinidad Steam Electric Station it is also doing for their smaller brothers. But the full benefits can only be realized if the plant designer selects with great care the best control equipment for his job. The control must be carefully matched to the boiler and auxiliary equipment characteristics; it must maintain maximum combustion efficiency under all load conditions.

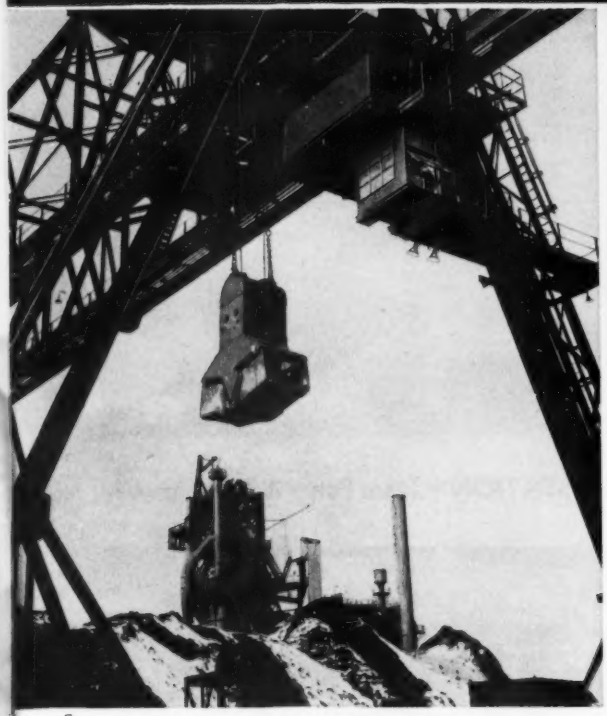
REPUBLIC CONTROLS are available for all types of load fluctuations, fuel firing, single or multiple fuels, and all types of boilers and auxiliary equipment. Backed by thirty-six years of specialized experience in combustion control, REPUBLIC'S power engineers have developed control systems to answer every type of steam generating problem.

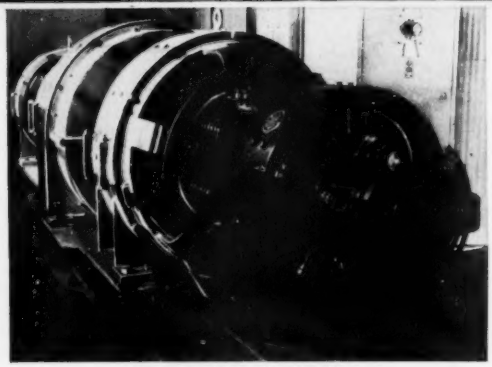
Ruggedly built to outlast the boilers that they serve, REPUBLIC AUTOMATIC CONTROL gives you the best, most economical system engineered to suit your needs.

For more information on REPUBLIC AUTOMATIC CONTROL write for Data Book No. S-21 or contact our field engineer nearest you.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

THE FINEST BRIDGE





VARIABLE VOLTAGE MOTOR GENERATOR SET

The use of the multi-unit Motor Generator Set with Amplidyne Drive provides adjustable voltage direct current to the various motors producing smooth starting and stopping and the fastest possible operation. Use of this MG Set, built by General Electric Co., provides greater efficiency than the rheostatic scheme by allowing greater horsepower output from the motors. The use of this system eliminates approximately two-thirds of the control weight normally carried on the trolley. Other advantages of this variable-voltage system are: reduced space requirements; lower maintenance cost; less power loss; and elimination of heavy copper conductors.

1.

1. An artistic view of the 12-Ton Ore and Coal Bridge, showing the Blast Furnace and Ore Pile in the background.

2. The entire Bridge showing bucket in position to unload ore from a lake vessel.

2.

This Ultra-Modern Bridge designed and erected by HEYL & PATTERSON Contains More Firsts and More "Advanced Improvements" Than Any Other Ore and Coal Bridge in Operation Today.

EVER BUILT

Designed and Erected by
***Heyl & Patterson* for**
DOMINION FOUNDRIES and STEEL, LTD.
Hamilton, Ontario, Canada

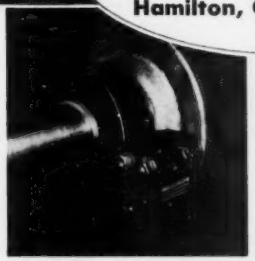
TRUCKS
The entire bridge is mounted on fabricated steel Trucks of extra heavy sections with 24 wheels under the pier leg and 24 under the shear leg. Trucks are arranged in 3 four-wheel, two-axle units, and each unit is driven by a separate motor. The standard-gauge, wide-rail spacing permits the bridge to run on crushed slag ballast.

ORE BUCKET
The Heyl & Patterson 12-ton Buckets used on this bridge are built to withstand extremely rough usage. All moving parts are connected by heavy steel pins having removable bushings and the bucket spades are equipped with heavy manganese steel digging lips. The coal buckets and ore buckets are interchangeable.

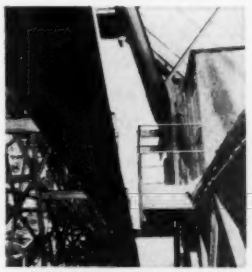
This modern 12-ton ore and coal bridge is a practical example of how Heyl & Patterson constantly plans ahead to provide the utmost in new and practical features for every project . . features that enable any H. & P. installation to operate smoothly, quickly, safely and economically.

Notice the many new and improved features of this bridge that contribute to its outstanding performance. The compact Turn-Table; the Fabreeka Mounting; the Variable-Voltage, Amplidyne Controls; the increased use of Welding . . . all designed to give this bridge better, longer performance with less maintenance cost than any other bridge.

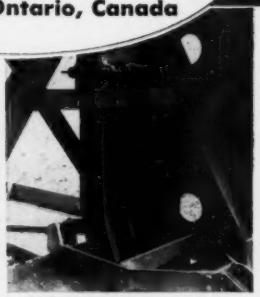
When faced with a Heavy Bulk Materials Handling problem, think of Heyl & Patterson— the firm with experience of the past and an eye to the future.



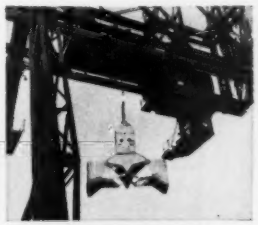
FABREEKA MOUNTING
Fabreeka Mounting is used in place of the conventional spring assembly. Fabreeka Mounting cushions and dampens the trolley; increases life of the Collector Shoes; absorbs and reduces vibration; requires no lubrication.



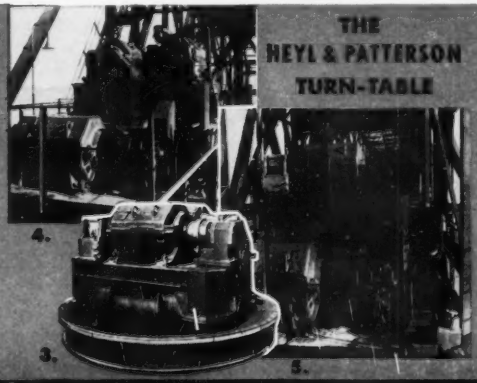
BRIDGE RUNWAY CONDUCTOR RAILS
A great saving in weight is made through the use of aluminum conductor rails. The power, 550 Volt, AC, is transmitted through the Collector Shoes.



H&P RAIL CLAMP
The Heyl & Patterson patented Rail Clamp is a never-failing safety device. Whenever the power circuit is opened the wedge-shaped counter-weight descends and forces the hardened serrated tool steel clamping plates against the sides of the runway rails.



MORE WELDING
The extensive use of welding on this bridge provides a saving of weight and added strength throughout the entire bridge. Notice the lack of rivets in the shear leg.



THE HEYL & PATTERSON TURN-TABLE

This bridge is the first installation utilizing the recently-designed Heyl & Patterson two-motor hoist mounted on a turn-table. The turn-table speeds the clean-up operation during unloading by allowing the bucket to dig from any angle in the hold of the vessel.

Because of its compact design, the trolley with the turn-table arrangement uses no more than 5% extra space between the trolley runway rails than is required for the standard trolley. This arrangement does not sacrifice accessibility of parts for inspection or repair.

The assembly is mounted on a welded lower member which is, in turn, carried on rollers supported in the trolley frame. 100° of motion can be obtained in either direction. The rotate motion is obtained by a motor driving through a reducer to a final bevel gear reduction.

3. Turn-Table. 4. The axis of the drum parallel to the trolley runway. Note wiring and gear casing. 5. The axis of the drum parallel to the bridge runway.

Heyl & Patterson, Inc.
"SINCE 1887"

Heavy Bulk Materials Handling Equipment
All The Way from Design to Erection

55 WATER STREET · PITTSBURGH 22, PA

MOVE IN STEAM

NO BRICKWORK — NO EXCAVATION — NO FOUNDATION

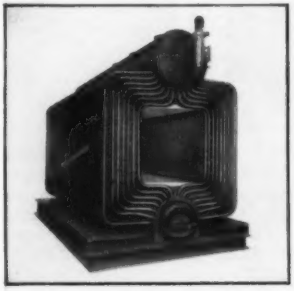
ERIE CITY

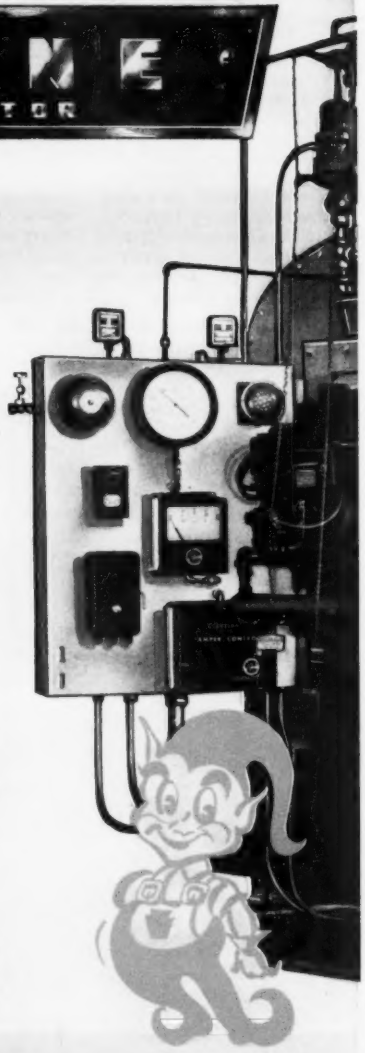
KEYSTONE

STEAM GENERATOR

JUST HOOK'ER UP TO SERVICES

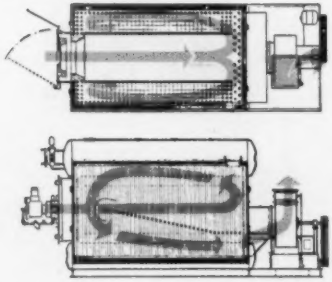
It's a compact, 2 drum *water tube* boiler heavily insulated and steel cased, complete with automatic oil or gas or combination burner. It has integral water cooled furnace. Keystones are available in standard capacities from 2490 lb. steam per hour and up as factory assembled units in a wide range of operating pressures. At the left is shown the bare boiler element to illustrate that Keystones are not ordinary packaged boilers. They are rated 5 square feet of heating surface per developed horsepower like largest water tube boilers.





UNIQUE 3 PASS GAS TRAVEL

Gas flow areas are proportioned to decreasing gas temperatures providing practically constant velocity and assure no pockets where unburned gases can accumulate. All boiler surfaces exposed to heat transfer are completely submerged below water line. Booklet SB38 tells the complete story.



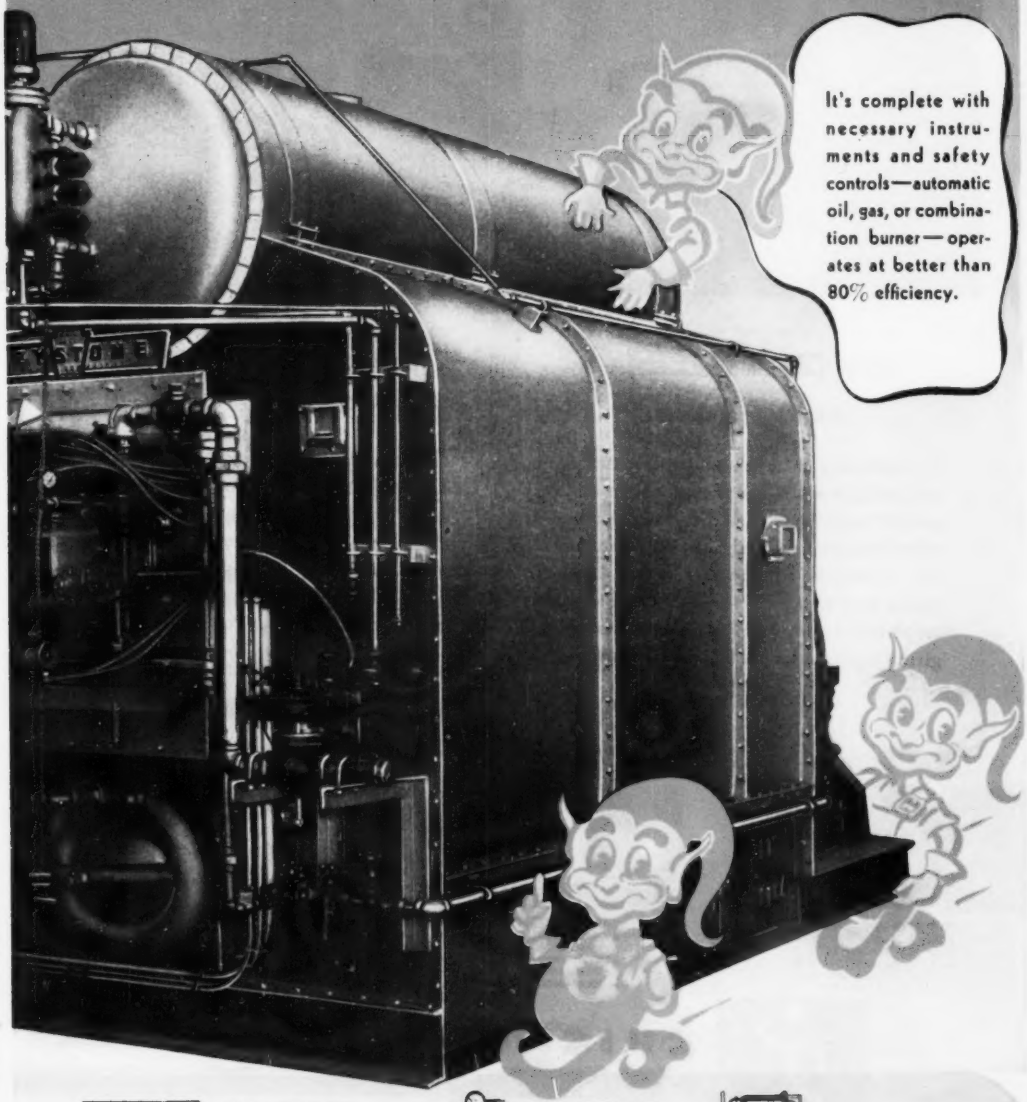
ERIE CITY IRON WORKS • ERIE, PA.

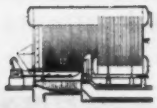
STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED and SPREADER STOKERS • PULVERIZERS

TO ORDER

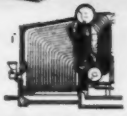
— NO COSTLY STACK — INSTALLS INDOORS OR OUTDOORS

It's complete with necessary instruments and safety controls—automatic oil, gas, or combination burner—operates at better than 80% efficiency.





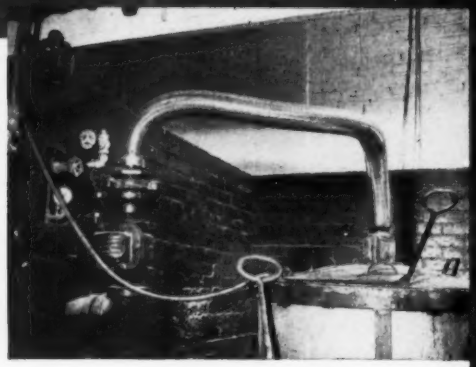
ERIE CITY VL horizontal 2-drum integral furnace, steel cased steam generators.



ERIE CITY VC vertical 2-drum integral furnace, steel cased steam generators.

ERIE CITY TYPE "C" 3-drum steam generators.

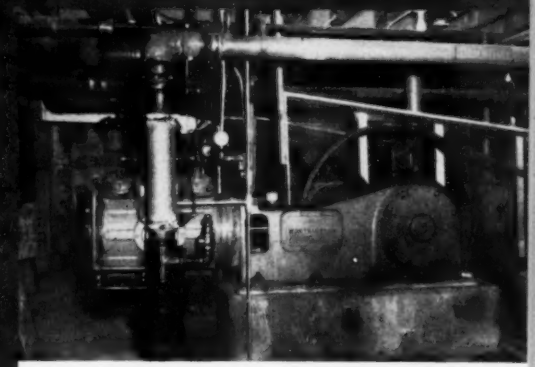
IF the connection must move . . .



use CMH flexible metal hose

In conveying materials—liquids, gases or dry granular solids—between two movable points, metal hose combines rugged durability with the required flexibility. In addition, metal hose is non-aging, non contaminating and non-collapsible. It offers high resistance to heat, cold and physical damage, giving excellent service under all conditions.

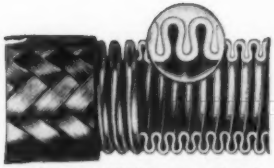
IF the connection vibrates . . .



use CMH flexible metal hose

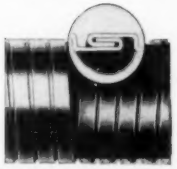
Connections subject to vibration will last longer if they are made with flexible metal hose. Equipment and rigid piping will last longer, too, because metal hose isolates the vibration, restricting it to that portion of the equipment that is built to absorb the vibration. Transmission of noise is minimized also, with metal hose connections.

There is a size and type



CMH REX-WELD corrugated steel and bronze hose is available in standard sizes from 3/16" through 12" I.D. for burst pressures to 12,000 psi, temperatures to 1000° F. Available with or without metal braid covering.

CMH REX-FLEX corrugated stainless steel hose is available in standard sizes from 5/16" through 6" I.D. for burst pressures to 24,000 psi, temperatures to 1600° F. Available with or without metal braid covering.



CMH REX-TUBE fully interlocked flexible tubing for ducting, exhaust, armor etc. is available in galvanized steel, aluminum, brass and other metals in sizes ½" through 12", I.D.

Descriptive literature available on all CMH hose types.

CHICAGO METAL HOSE

1301 S. Third Avenue Maywood, Illinois

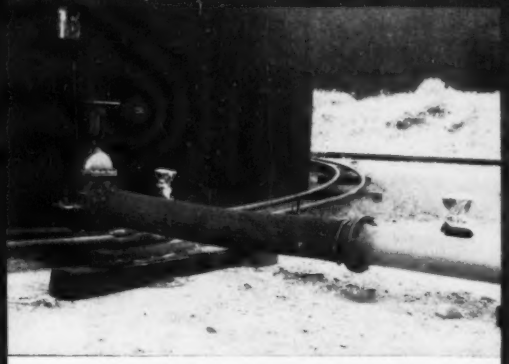
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

Manufacturers of Flexible Metal Hose, Metallic Bellows,

Flexon identifies CMH products that have served industry for over 50 years

CMH

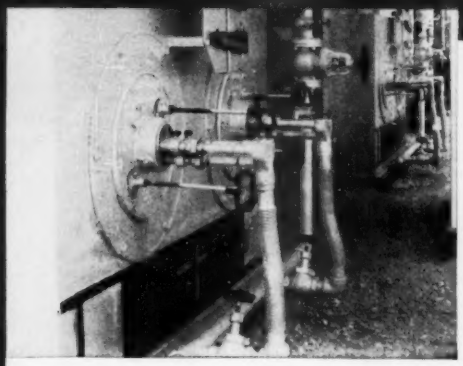
IF the connection is misaligned . . .



use CMH flexible metal hose

Joining misaligned sections of piping is greatly simplified when flexible hose is used to bridge the gap. Savings in assembly time and in fittings generally will pay the cost of the hose. At the same time, metal hose provides a neater installation that is practical, efficient and completely leaktight and dependable.

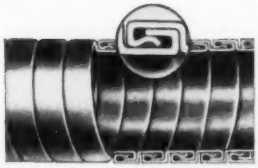
IF the connection absorbs expansion . . .



use CMH flexible metal hose

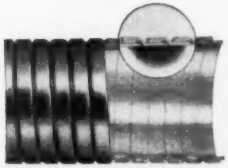
In the many types of equipment where thermal changes cause expansion and contraction, the motion is easily absorbed by flexible metal hose without sacrificing any of the tightness or dependability of the connection. Flexible metal hose makes it possible to solve an otherwise difficult problem quickly, simply and economically.

to meet every need . . .



CMH REX-TUBE fully interlocked flexible metal hose for steam, tar and asphalt, grease, etc. is available in galvanized steel or bronze in standard sizes from ½" to 12", I.D.

CMH REX-TUBE ball bearing type utility hose for non-searching fluids is available in bronze, galvanized steel or stainless steel in standard sizes from 5/32" through 1½", I.D. Available with or without metal braid covering.



CMH "Abrasion Resistant" flexible galvanized steel tubing is especially designed for handling dry granular solids such as grain, slag, asbet, etc. Standard sizes 2½" through 12", I.D

See your classified telephone directory for the distributor nearest you.

Division, Flexonics Corporation

Plants at Maywood, Elgin, Rock Falls and Savanna, Illinois and Memphis, Tennessee

Expansion Joints for Piping, and Aircraft Components

POWERHOUSE PUMPS

Use This Pump Laboratory

TO STUDY ACTUAL SUCTION CONDITIONS BEFORE CONSTRUCTION STARTS

CORRECTING PUMP SUCTION CONDITIONS after your powerhouse is built can be mighty expensive. You can avoid this danger by testing your suction bay design in this Allis-Chalmers test laboratory.

This unit will duplicate the shape and water flow conditions of your suction bay and show you just how your circulating pumps will operate after installation. You can experiment with the shape and size of the suction bay, test various positions for foundations and pilings, check the effect of adding more pumps at a later date, plot operating characteristics at various loads; in fact, duplicate almost any suction condition that you may encounter in your plant.

Available to Consulting Engineers and Power Plant Operators

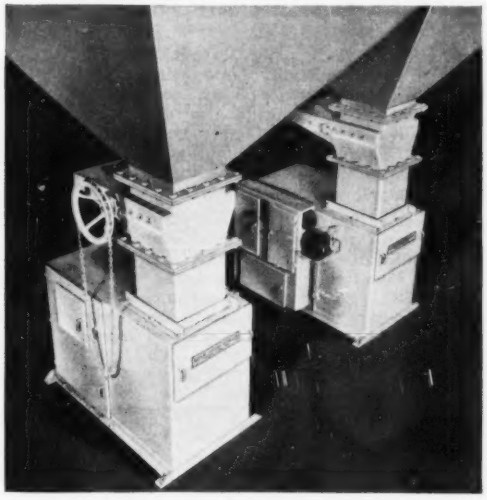
The pump testing facilities of the Allis-Chalmers research laboratories are available at the West Allis, Wisconsin, Works to all consulting engineers, utilities and power plant operators concerned with large pump operation. If this pump testing laboratory can help you, call your Allis-Chalmers District Office or write Allis-Chalmers, Milwaukee 1, Wis.

A-3782

ALLIS-CHALMERS

The B.T.U. Chaser With a Slide Rule

Two S-E-Co. Automatic Coal Scales with S-E-Co. Coal Valves feeding pulverizers.



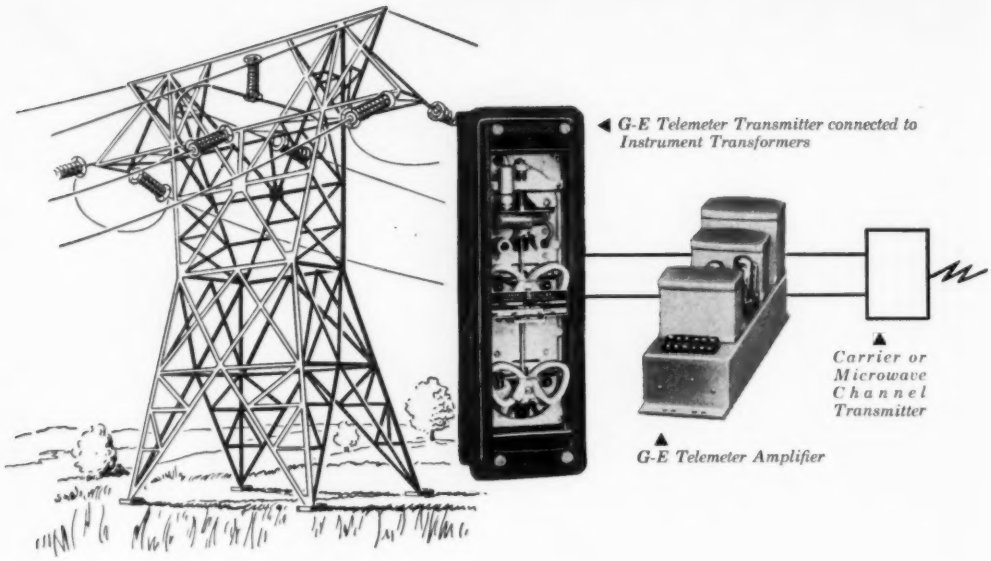
must have available accurate information of coal input to calculate the efficiency of each boiler. S-E-Co. Coal Scales provide this data for any desired time period.

S-E-Co. Coal Scales, weighing coal to the individual pulverizers, also allow the pulverizer feeders to be balanced. In this way each burner may be adjusted to give the maximum CO_2 percentage and may be operated at its highest efficiency, hour after hour.

B. T. U. chasers find S-E-Co. Coal Scales valuable and necessary tools to assist them in catching the last possible B. T. U.

For additional information, write for our Coal Scale Bulletin.

STOCK EQUIPMENT COMPANY
745 P HANNA BUILDING
CLEVELAND 15, OHIO


◀ G-E Telemeter Transmitter connected to Instrument Transformers
Carrier or Microwave Channel Transmitter
G-E Telemeter Amplifier

See every load change

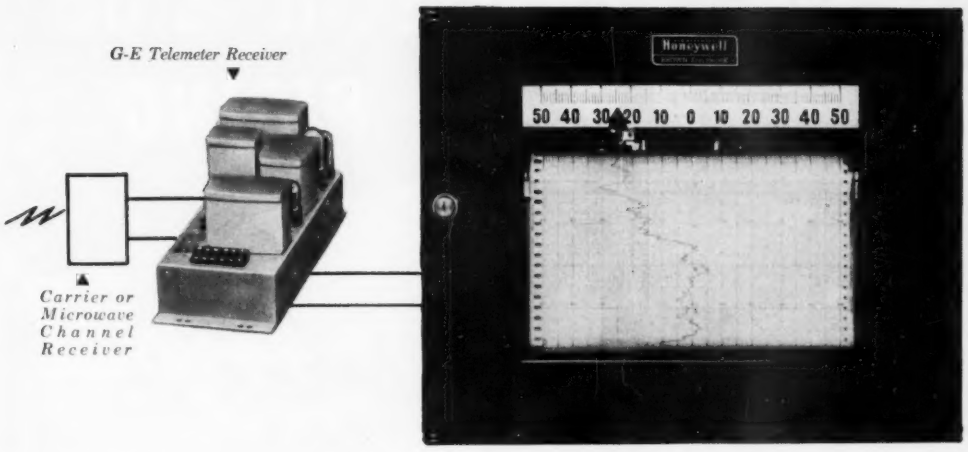
Flexibility...Dependability... for all power plant measurements

The versatile *ElectroniK* Recorder is applicable to measurement of pressure, flow, speed, pH, conductivity, power, current, temperature . . . the *same basic instrument for all*, with changes only in measuring circuit and sensing elements. Use of standard, interchangeable components simplifies maintenance, reduces parts-stocking problems. Single-point and multi-point models are available in a choice of printing speeds, and with chart speeds from ½" to 120" per hour.

The utmost in dependability demanded by power plant applications is insured by *ElectroniK* components . . . life-tested, service-proved, designed for minimum, easy maintenance. These rugged "building blocks"—the high-torque balancing motor, the hermetically sealed converter, the simplified continuous-balance amplifier—typify construction that minimizes the number of moving parts, and that eliminates troubles from dust and atmospheric humidity.

● *Important Reference Data*

Write for Instrumentation Data Sheet No. 9.1-10, "Long Distance Transmission of System Variables"... and for



ElectroniK Recorder

General Electric frequency-type telemetering system with ***ElectroniK*** *strip-chart recorder*

the instant it happens...

through continuous telemetering with ElectroniK RECORDERS

THE ultra-fast telemetering equipment shown above keeps the load dispatcher in constant touch with all parts of the system. It tells him every change in tie line interchange, in station generation and in system load—the instant that a change takes place. Operating over carrier current or microwave channels, it spans distances of hundreds of miles . . . eliminates the delays and uncertainties of intermittent, non-continuous measurement.

The *ElectroniK* recorder presents load data in full, readable detail on its big, 11-inch-wide strip chart, where every significant change and trend stands out for the dispatcher's attention. The rapid response of *ElectroniK* continuous-balance measuring assures full utilization of the inherent speed of the telemetering equipment. And the industry-proved dependability of *ElectroniK* construction means absolute minimum maintenance, and uninterrupted performance.

Your local Honeywell engineering representative will be glad to give you full details. Call him today —he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Pa. Service available promptly from more than 55 offices in principal cities of the United States.

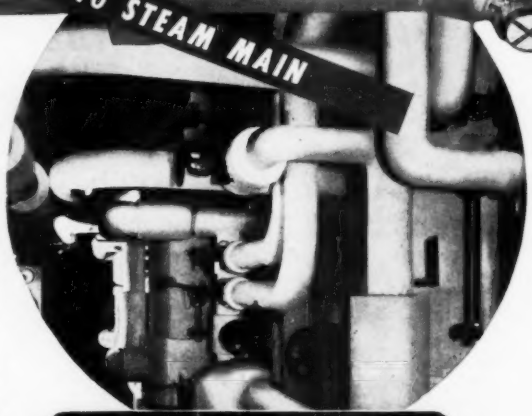
MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Bulletin 90-2, "Supervisory Instruments for Power Generation."

WHEN THE PRESSURE IS ON P.P.&E. PIPING

has what it takes

FROM CONTROL PIPING TO STEAM MAIN



Today's 1000°F and higher temperatures, combined with pressures in the 2000 psi range—really "put the pressure" on a piping system. It could be said that these higher, and perhaps even higher pressures to come, will force new standards of piping.

But—remember when 750°F was considered to be a high reheat temperature? Even then, P.P.& E. was ahead of the needs in piping to carry the load. As the trend toward higher temperatures continued—P.P.& E. has kept ahead of the requirements.

That's why conditions encountered in present-day reheat temperatures are thoroughly understood by P.P.& E. engineers—and why adequate materials, design know-how, methods of treating and fabricating, and testing procedures are available.

When the "pressure is on" you can depend on every part of a P.P.& E. piping system—from the steam main, right down to the air lines.

Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
785 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
101 High Street, Boston
Heights State Bank Bldg., Houston

Unloading Hopper Cars

IS A FAST, ONE-MAN OPERATION

Unloading Time

Actual examples with Allis-Chalmers car shaker. Good unloading facilities.

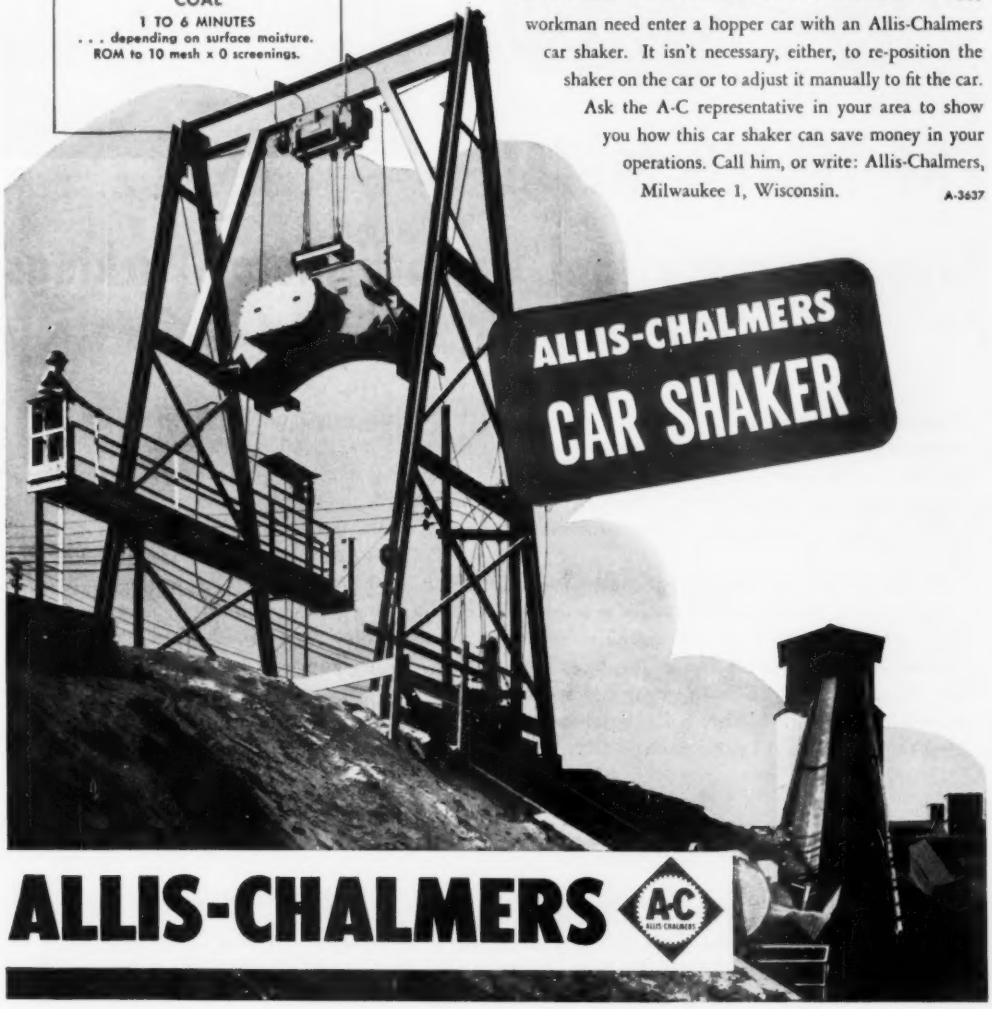
WET SAND
1½ TO 2¼ MINUTES.

ROCK
½ TO ¾ MINUTES
. . . ½ to 6 in. crushed material.

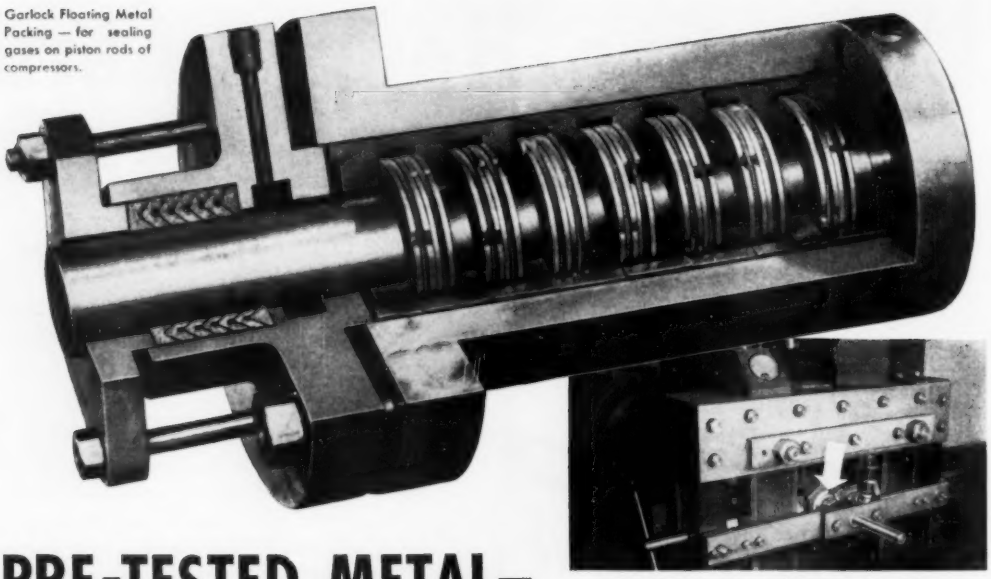
COAL
1 TO 6 MINUTES
. . . depending on surface moisture. ROM to 10 mesh x 0 screenings.

YOU CUT UNLOADING COSTS . . . Push a button and your Allis-Chalmers car shaker will empty a hopper-bottom car in *minutes* . . . and cleanly, too, even if your bulk material is damp, compacted or partially frozen. In addition, it promotes an even flow of material from the unloading station.

YOU REDUCE UNLOADING HAZARDS . . . No workman need enter a hopper car with an Allis-Chalmers car shaker. It isn't necessary, either, to re-position the shaker on the car or to adjust it manually to fit the car. Ask the A-C representative in your area to show you how this car shaker can save money in your operations. Call him, or write: Allis-Chalmers, Milwaukee 1, Wisconsin. A-3637



ALLIS-CHALMERS A-C ALLIS-CHALMERS



Garlock Floating Metal Packing — for sealing gases on piston rods of compressors.

Above: Arrow points to foundry specimen being wear-tested on specially designed machine.

PRE-TESTED METAL—

Your assurance that Garlock Metal Packings are right for the job!

Designed specifically for high pressure and high temperature service to seal air, ammonia, steam or any gas on piston rods of compressors and steam engines, Garlock Metal Packings are quality-controlled throughout their entire manufacture.

Starting with the metals of construction, every "heat" of cast iron and bronze is accelerated-wear-tested on a special machine by an independent organization before the materials are shipped to Garlock. If the wear test specimen does not pass Garlock's rigid standards, then the entire "heat" is rejected.

Then, using these tested, high-grade materials, Garlock Metal Packings are accurately machined to exacting specifications by experienced craftsmen. Throughout every operation extreme precision is the watch-word.

The product of this rigid pre-testing and precision manufacture is a metal packing that you can be sure will meet your service requirements. So, standardize on Garlock Metal Packings—they last longer, require less maintenance.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK FLOATING METAL PACKINGS

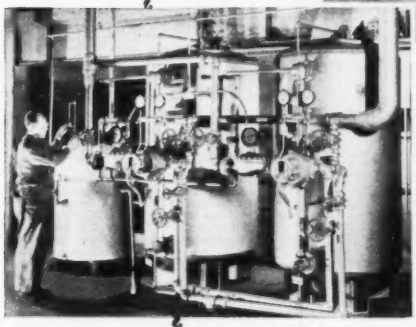
ALLIS-CHALMERS

Water Conditioning

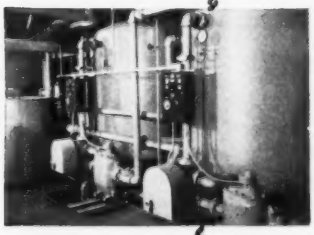
CHEMICALS — EQUIPMENT — SERVICE

FOR WATER *that Fits Your Needs*

This hot process lime-soda softener for treating makeup to high-pressure boilers is rated at 5000 gph.



Sodium zeolite water conditioning equipment with capacity of 130 gpm provides boiler makeup to evaporator in an eastern utility power plant.



Dual automatic sodium zeolite water softener rated at 225 gpm is used in power plant of a Texas hospital.

TO ASSURE YOU water conditioned to your specific requirements, A-C engineers can draw on years of experience treating all types of water . . . plus a broad background of building turbines and processing equipment that are dependent on properly treated water. A-C water conditioning service includes:

Chemicals — for external and internal boiler water treatment . . . designed for silica removal and control of scale, corrosion and carryover. Also cooling cycle treatments . . . and dependable reagent chemicals.

Equipment — hot and cold process softeners . . . sodium and hydrogen zeolite softeners . . . alkalinity-reducing ion exchangers . . . deionizers . . . degasifiers . . . deaerating heaters . . . chemical feeding equipment . . . pumps . . . oil removal and water filters.

Comprehensive consultant service — surveys, reports . . . chemical and X-ray analysis . . . special studies.

WRITE FOR THESE BULLETINS

28X7636 — Meaning, Application and Measurement of pH

28X7559 — Hot Process — Hot Zeolite System

2886611 — Hot Process Softener

2887107 — Sodium Zeolite Softener

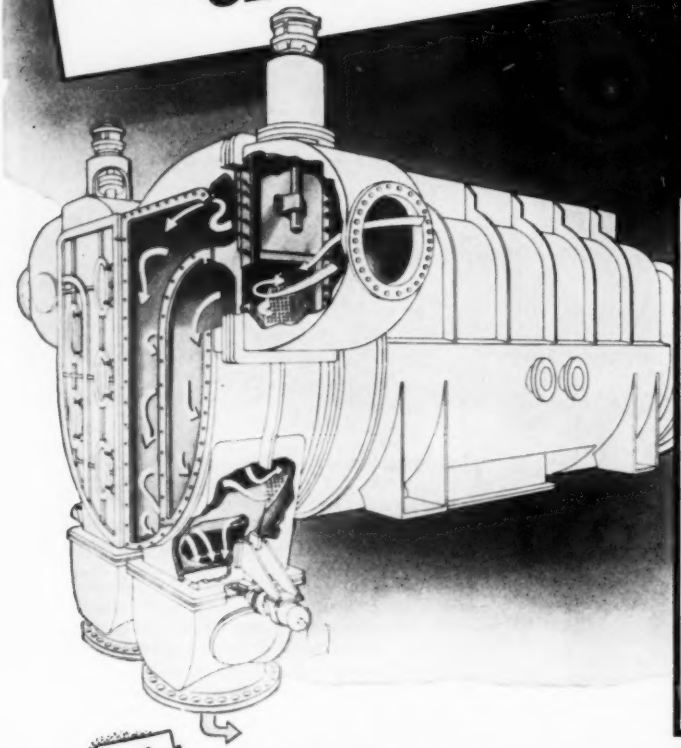
28X7808 — Alkalinity-Reducing Ion Exchanger

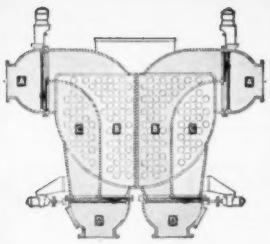
ALLIS-CHALMERS

A-3827

Milwaukee 1, Wisconsin

Here's a 3-WAY "ASSIST" On Your Power Plant Problems





HERE IS HOW REVERSE FLOW WORKS

Reverse flow sluice gates on divided water box condensers work the same in both halves but independently of each other. Right side: normal flow. Water enters divided water box in valve chamber "A" with lower port open. It flows through pass "C" to end of condenser, back through pass "B" and out through left port of "D."

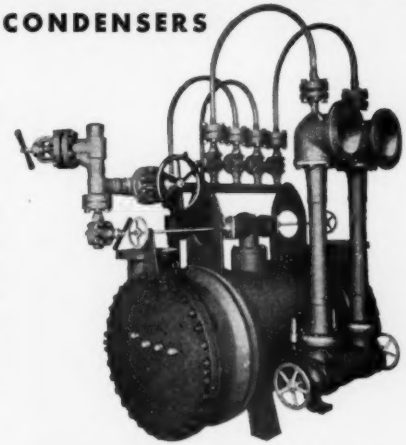
Left side: flow is reversed. Valves at inlet "A" and discharge "D" are changed to permit water to flow through "B" and back through "C" in the opposite direction and then out through the left port of "D."

1 CLEAN DEBRIS FROM CONDENSER TUBE SHEETS WITHOUT DOWNTIME OR LOSS OF VACUUM

C. H. Wheeler "Reverse Flow" Condenser design provides a powerful self-cleaning flushing force by the simple procedure of reversing the flow of water through the tubes. Electrically or hydraulically controlled sluice gates accomplish in minutes cleaning that consumes hours of downtime when removal of debris is done by hand. Power plant modernization calls for the efficiency and uninterrupted operation of C. H. Wheeler "Reverse Flow" Condensers. You don't need costly water straining apparatus. Send for latest bulletin #410.

2 VACUUM PUMPS WITH LOWEST MAINTENANCE FOR YOUR STEAM CONDENSERS

C. H. Wheeler Steam Jet Ejectors are the development of 35 years of pioneering in this field. Known as "Tubejets," these vacuum pumps have no moving parts. Hence, they are simple to operate, require almost no maintenance and last longer. Modern Power plants use single or two-stage Tubejets with surface inter-after condenser for the vacuum requirements of steam condensers. Special arrangements of standard Wheeler ejector assemblies can be provided for any unusual installation or performance requirements. Catalog #1462 gives you detailed descriptions and some useful temperature and pressure conversion tables. Write for it.



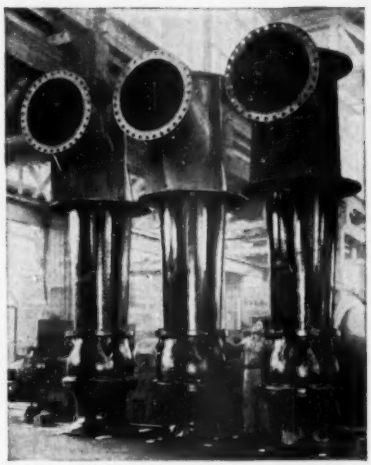
SPECIAL TYPE TUBEJET VACUUM PUMP FOR HIGH PRESSURE AND HIGH SUPERHEAT

3 WHEELER-ECONOMY CIRCULATORS HANDLE LARGER VOLUMES OF WATER AT LOWER COST

Wheeler-Economy Pumps for Condenser Cooling Water Circulation are made in horizontal double suction and vertical submerged, axial mixed flow types. These pumps are noted for reliability, the result of superior modern design and heavy duty, quality construction. They are built in all sizes to meet capacity requirements up to 200,000 GPM. Wheeler-Economy Circulating Pumps are also furnished in special metals to handle corrosive waters. The impellers are designed for satisfactory operation during all load requirements.

Economy engineers are pioneers in the successful application of axial flow pumps in circulator service. These pumps can be furnished in "pull-out" type with distinctive design features, permitting removal of all operating parts, without dismantling the complete pump or disturbing any pipe connections.

For top performance in power plant duty count on Wheeler-Economy Pumps. Write for catalogs #G-349 and G-1050.



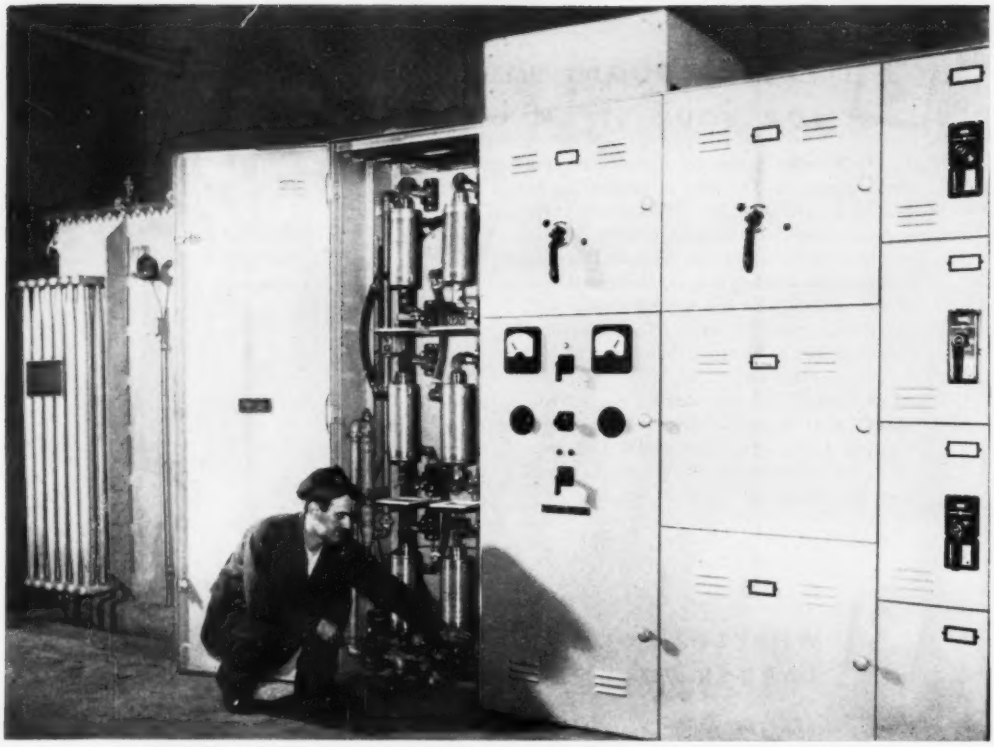
THREE CIRCULATORS OF 28,000 G.P.M. CAPACITY. 35 FT. TDH, 575 RPM.

105-R

C. H. WHEELER *of Philadelphia*

C. H. WHEELER MANUFACTURING CO., 19th & LEHIGH, PHILADELPHIA 32, PENNA.

Steam Condensers • Centrifugal, Axial and Mixed Flow Pumps • Steam Jet Ejectors • Cooling Towers • Vacuum Refrigeration
High Vacuum Process Equipment • Micro-Particle Reduction Mills • Marine Condensers and Ejectors • Deck Machinery



THIS G-E RECTIFIER AT ALLIANCE HAS REQUIRED NO MAINTENANCE SINCE INSTALLATION IN 1950.

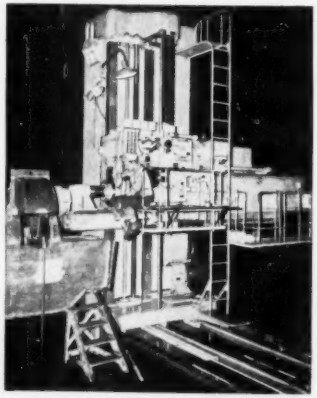
Producer of world's largest cranes uses 300-kw rectifiers for DC power

Alliance Machine Co. gains higher line efficiencies by using General Electric Ignitron Power Rectifiers

In the manufacture of mammoth cranes and other heavy factory equipment, the Alliance Machine Company, Alliance, Ohio, depends on the d-c power from its G-E Ignitron Rectifiers to run hundreds of machine tools throughout the plant.

Installed late in 1950, the mercury arc rectifiers have been in service ever since, requiring no maintenance, with not even a tube needing replacement.

The G-E Ignitron Rectifiers, such as those at Alliance, operate 24 hours a day, 7 days a week. Supplied as a complete packaged unit with transformer and metal-enclosed switchgear, the installation occupies minimum space. For information on a G-E Ignitron Rectifier to fit your d-c power needs, call or write your nearest G-E sales office. General Electric Company, Schenectady 5, N. Y. 324-7



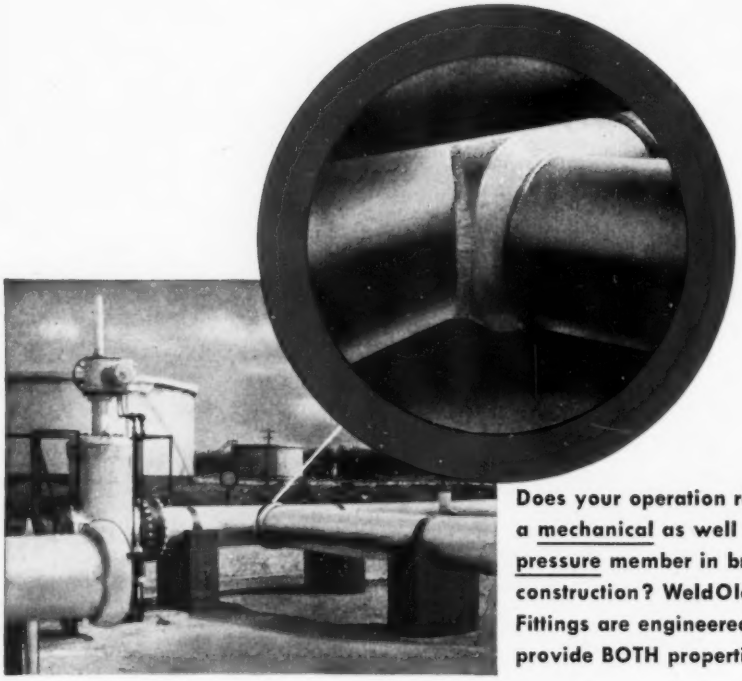
This giant boring mill operates on d-c power supplied by the 300-kw G-E Ignitron Rectifiers at Alliance.

GENERAL ELECTRIC

nalco®
A chemical service organization . . . guiding industry toward more efficient use of water.
NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois

ENGINEERED REINFORCEMENT

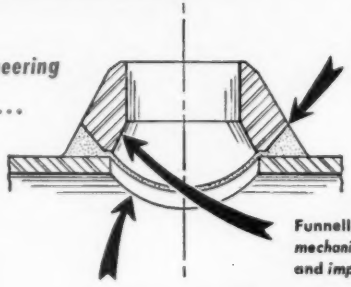
FOR YOUR BRANCH CONNECTIONS



Does your operation require a mechanical as well as a pressure member in branch construction? WeldOlet Welding Fittings are engineered to provide BOTH properties.

A big portion of your engineering job is done for you, if you...

Specify Bonney WeldOlet Welding Fittings to Insure Permanent Strength



Reinforcement where both the mechanical and internal *stresses are most severe*

Funnelled to relieve *mechanical stress concentrations* and *improve fluid flow*

Shaped and beveled for *clean, quick and economical installation*

FOR COMPLETE ENGINEERING DATA WRITE FOR YOUR BONNEY W3 WELDOLET CATALOG

WELDING FITTINGS DIVISION

BONNEY FORGE & TOOL WORKS

ENG. DEPT., 350 GREEN STREET

ALLENTOWN, PENNSYLVANIA

Featherweight Power

SOME MANUFACTURER is missing a big bet in the field of featherweight portable power. We mean, specifically, self-powered tools, not dependent on an electrical connection, light enough to hold in one hand.

The available electric power tools are doing a wonderful job, but they don't help the man who must work beyond the convenient reach of an electric outlet. So millions of dollars are still being wasted in hand-powered operations.

True, an impressive start has been made. Probably the outboard motor is the best example. It gave man a substitute for muscle-powered oars. People found that a penny's worth of gasoline would carry a boat farther than an hour of human sweat, so the outboard became a big institution and a big business.

In recent years we have seen a rapid rise in power lawn mowers and garden cultivators. Right now the sensational chain saw is rapidly replacing the ax and hand saw for tree cutting.

Yet everything accomplished to date in portable nonelectric tools is as nothing when compared with what remains to be done. We need "featherweight" gasoline-powered tools far more portable than anything yet on the market. There are many possible applications.

Probably the first application would be for drilling. Picture a portable drill powered by an ultra-high-speed, featherweight, air-cooled engine with a double speed reduction. The whole unit might weigh less than 15 pounds. Such a tool, reasonably promoted, would sweep the country and soon lead to other equally portable self-powered tools for sawing and similar uses.

Pioneer thinking will be needed, for the featherweight engines must differ radically from the relatively cumbersome units now used to drive lawn mowers, for example. They must even surpass the latest and smallest air-cooled outboard motors in speed and extreme lightness. It is impossible to overemphasize the importance of lightness. Since these tools must be toted by hand, every pound sweated off by smart engineering will mean a tremendous aggregate saving in human energy.

We believe there are engineers and manufacturers in America who have the needed combination of originality and practicality to produce such units. If the tools they offer are reasonably reliable *and light enough*, we believe that their commercial success will be assured. For who could imagine that Americans would fail to use a gadget that made one man as good as 10 or 20 working without power? Our people are increasingly receptive to labor-saving common sense—doing more with less effort.

In the not-too-distant future, we hope to be able to write a follow-up editorial titled, "We Told You So," announcing the fulfillment of this economic dream and congratulating those who did the deed.

Only Edward Offers Streamlined Flow

From 1/4" to 16"....Edward Gives You Streamlined Flow in Globe, Angle, Check, Non-Return, Blow-Off, Gate and Feed Line Valves...in Cast and Forged Steel!

In today's trend to higher pressures and temperatures, with resulting increased erosion, streamlined flow plays an even bigger role in keeping valve operating and maintenance costs down . . . and system efficiency high.

Pioneered by Edward—developed after years of extensive flow tests and experiments with plastic models, prototypes, and much specially designed equipment in the largest laboratory in the world devoted exclusively to steel valve research—Edward *Streamlined Flow* offers these four outstanding advantages.

1. Reduces wear-producing turbulence—giving longer life to seat, disk, and other moving parts.
2. Lower pressure drop.
3. Delivers maximum flow where needed.
4. Often permits use of smaller pipe and valve sizes.

With Edward's broad range of valve sizes and types with streamlined flow, you can get peak valve operating efficiency . . . all-across-the-board, *wherever* valves are used. *A product of* Edward Valves, Inc., 1220 West 144th Street, East Chicago, Indiana.

Edward ...BIRTHPLACE OF BETTER VALVE DESIGNS

—IN A FULL RANGE OF VALVE SIZES

These illustrations show wear-reducing Edward streamlined flow in both small and large valves. Small valve demonstrates straight through, full flow channel of Edward Univalve. Large valve is Edward globe stop valve . . . note smooth, economical flow pattern.

FEATURES LIKE THIS SAVE YOU MONEY

That's why it pays to specify Edward Valves

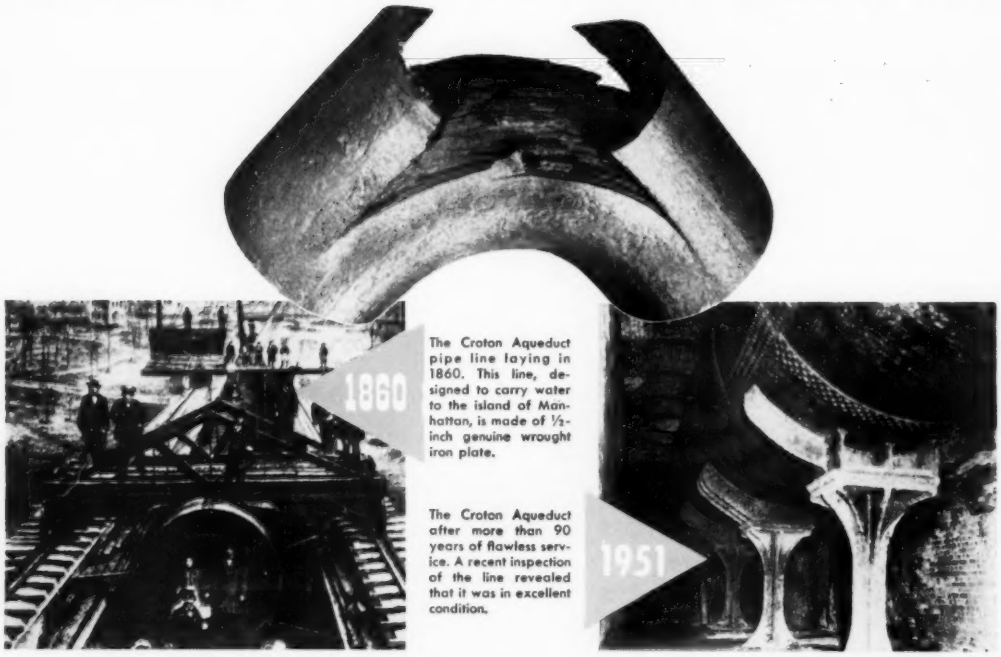
Another Product

Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

Here's why GENUINE WROUGHT IRON



The Croton Aqueduct pipe line laying in 1860. This line, designed to carry water to the island of Manhattan, is made of ½-inch genuine wrought iron plate.

The Croton Aqueduct after more than 90 years of flawless service. A recent inspection of the line revealed that it was in excellent condition.

makes INSTALLATIONS LAST

Remarkable genuine wrought iron performance records similar to the Croton Aqueduct installation are recorded for a wide variety of services in practically every industry. The secret behind this material's ability to extend its "life-span" in corrosive services is illustrated in the notch-fracture test specimen pictured above.

This notch-fracture shows the unique fibrous structure of genuine wrought iron. Tiny threads of glass-like silicate slag, 200,000 to 250,000 per square inch of section, are distributed through the body of high-purity iron. These slag fibers are unaffected by corrosion, and set up mechanical barriers that halt and disperse corrosive attack, discourage pitting and rapid penetration. The fibers also anchor the initial protective scale, which shields the underlying metal.

Genuine wrought iron's service records from the past are providing an increasing number of the nation's leading engineers and designers with a reliable guide for material selection today. We will welcome the opportunity to review your corrosion problems with you —and to recommend the places where genuine wrought iron—on the basis of past experience—can be used to help cut maintenance costs.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, N. Y.

Send for this booklet Today

Interesting case studies of genuine wrought iron installations from the past are presented pictorially in this new, non-technical booklet, "Proof by Performance." There's a copy waiting for you.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

water

a special editorial report

Power – September 1952

Except in some areas, like the Southwest, ours is a water-rich land. Yet today water supply has become a major U.S. problem. Rising use for homes, agriculture *and* industry has outgrown many local supplies. So, over much of the nation, we must reach farther and deeper for water. Meanwhile the problem has been increasingly complicated by the often conflicting claims of navigation, hydro power, flood control, wildlife conservation, recreation, etc.

Thus water, which is primarily an engineering problem, has become everybody's business. Through their elected representatives the American people are saying (not always wisely) what shall be done about development of water sources and restrictions on water use.

Meanwhile, in industry, the engineer must handle increasingly complex water situations. These require him to work more closely than ever with management, because water supply has become a matter of top policy. Here is another field where the engineer's technical skill must be teamed with an understanding of financial, political and human factors.

This proves both an opportunity and a threat – an opportunity for engineers to practice the cooperation so often preached – a threat to community health, prosperity and industrial profits if the engineer should fail to win adherence to sound technical principles.

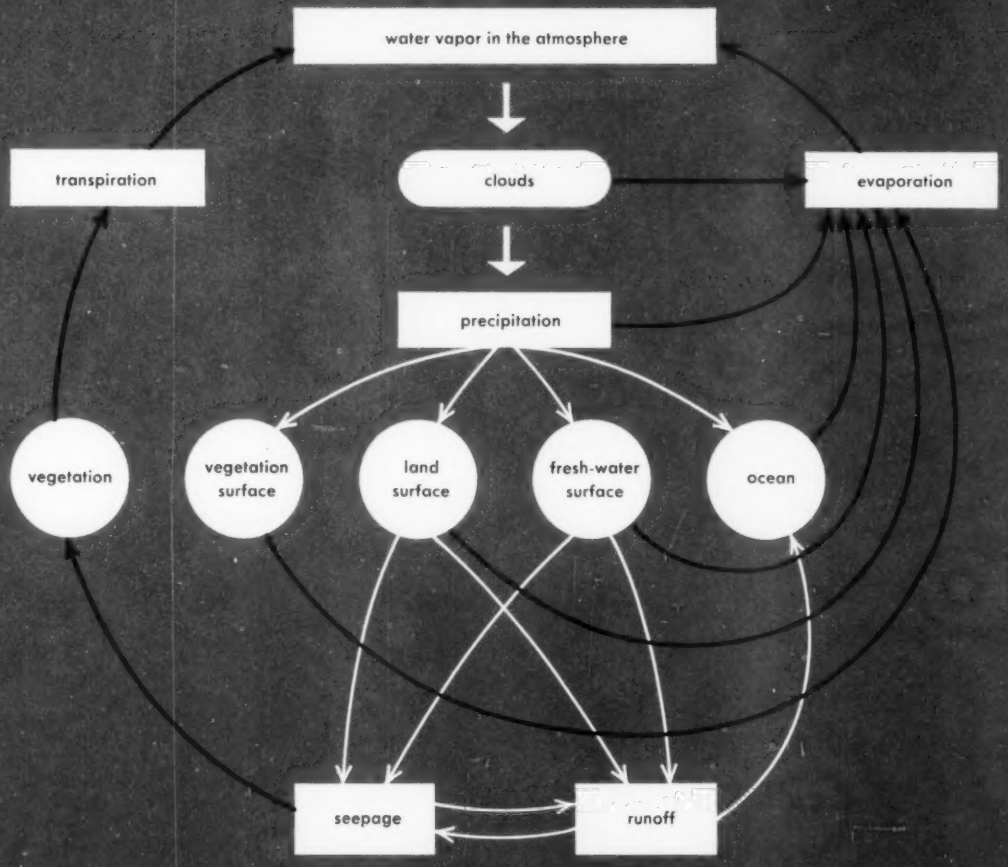
Viewing this situation, the editors of POWER have been working for nearly a year to create a presentation of water fundamentals that would be equally helpful to engineers and to those non-engineers who are leaders in industry, government and community life. Here is its final form – a treatment unique in POWER's long history. Of our more than 80 special sections, published over the past 17 years, this one alone aims to serve all policy-making Americans, including our normal engineer audience. It speaks to all who can direct or influence water planning.

This story of water, 48 pages in all, falls naturally into three equal parts: *The World of Water* – a nature story of water, land, wind and weather; *Water Shortages in a Land of Plenty* – why they occur and what is being done about them; *A Water Program for Your Plant* – sources, purification and conservation of water.

We hope that thousands of power engineers, after years of grappling with daily water problems, will welcome this broader view. And we hope also that the policy makers of American industry and government will find here a straightforward statement of important truths – sound engineering facts and thinking told in plain words.

The Editors

The world of water

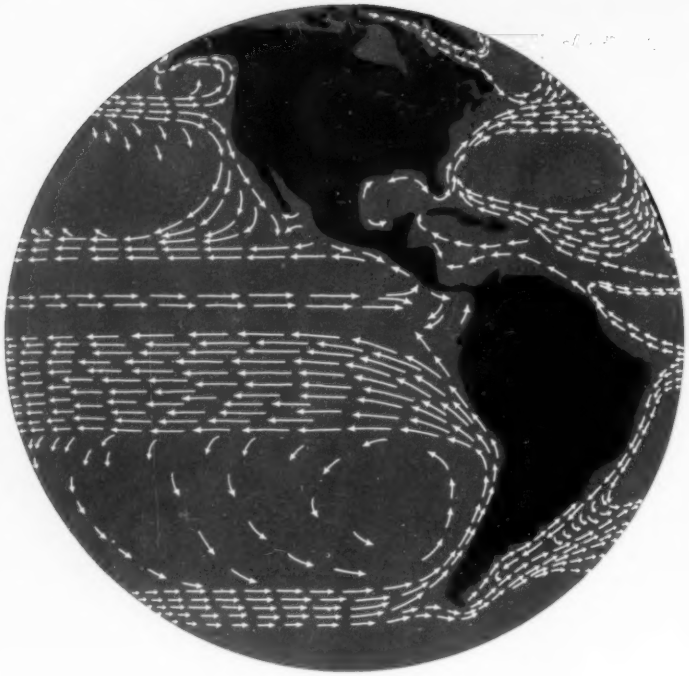


In these paths the world's fixed supply of water circles endlessly . . .

between sky, land, ocean and back to sky, urged along by the forces of nature.

Rising salt-free from the ocean, water is wind-borne across the land, partly as invisible true vapor, partly as the tiny condensed droplets of clouds and fog. Some of this air-held moisture falls to earth as rain, snow, sleet or hail.

Once there, a minor fraction makes a quick return to the ocean as runoff. Some goes underground and either seeps slowly back to the ocean or feeds plant roots. But most earth-bound water returns to the atmosphere by evaporation from land and water surfaces, and by transpiration (a form of evaporation) from plant surfaces.



Ocean currents . . .
handle far more ton-miles than all nature's remaining ways of transporting water. Rotation of the earth, convection forces created by tropic heat and polar cold, action of prevailing winds, all combine to move vast masses of warm and cold water. At an unhurried three miles an hour, these currents flow majestically in unmarked but familiar paths across the ocean wastes. In so doing, they cause shifts in the earth's delicate heat balance, profoundly influencing the weather, and hence the water supply, far into the continental land masses.

. . . rising from great ocean reservoirs to be . . .

The world of water is a world of unceasing cyclical movement. We usually think of it as pictured on the preceding page, with the atmosphere as the focal point from which rains fall and to which water returns by evaporation. If we now change our point of view, taking the ocean as the center of the cycle, we gain new understanding. We then see the world of water as a vast mechanism for distilling water from great ocean reservoirs, with the sun as the source of energy and the winds as conveyors.

This mechanism contains an unchanging amount of water, the same today as at Genesis. But the distribution of this water — in the ocean, in the atmosphere, on and under the land — varies from minute to minute. The ocean covers about three-quarters of the globe, and would still be two miles deep if the whole solid surface of the earth were leveled off uniformly. Wringing all the vapor out of the atmosphere would add only one inch to this 2-mile depth — a mere thousandth part of one percent.

The sun, which synthesizes man's food and keeps him from freezing, also brings him the water of life. From the undrinkable ocean brine, solar energy distills off pure water vapor. The winds circulating in the troposphere — the turbulent lower layer of the atmosphere — carry these vapors far over the great continental land masses.

High as the topmost clouds, the troposphere is only seven miles thick, an extremely thin film around a globe more than 8000 miles in diameter. This troposphere is the world's weather layer — the area of turbulence and moisture transportation. In the stratosphere, the layer next above, there is no weather as we know it. Meteorologists now believe, however, that "jet streams" in the stratosphere control weather in the troposphere.

Man sees rain falling from the sky, thinks of atmospheric water movement as vertical. Yet the main movement of air-borne moisture is horizontal. It travels in the form of vapor and clouds, often for thousands of miles, before dropping as rain.

When rain starts running over and through the ground, it carries with it dissolved minerals and minute particles of silt. The rivers and underground water courses carry this pollution into the ocean. Here it has accumulated for millions of years to make the ocean waters undrinkable and unusable for most of man's purposes.

And yet, as we have seen, the ocean is the reservoir and source of man's purest natural water — the rain.

Summer winds . . .
fall into two great moisture-bearing systems: the belt of easterly trade winds north and south of the equator, and a broad belt of prevailing westerlies nearer each pole. Because land and water do not heat and cool alike, continental land masses change direction of winds blowing in from the ocean.

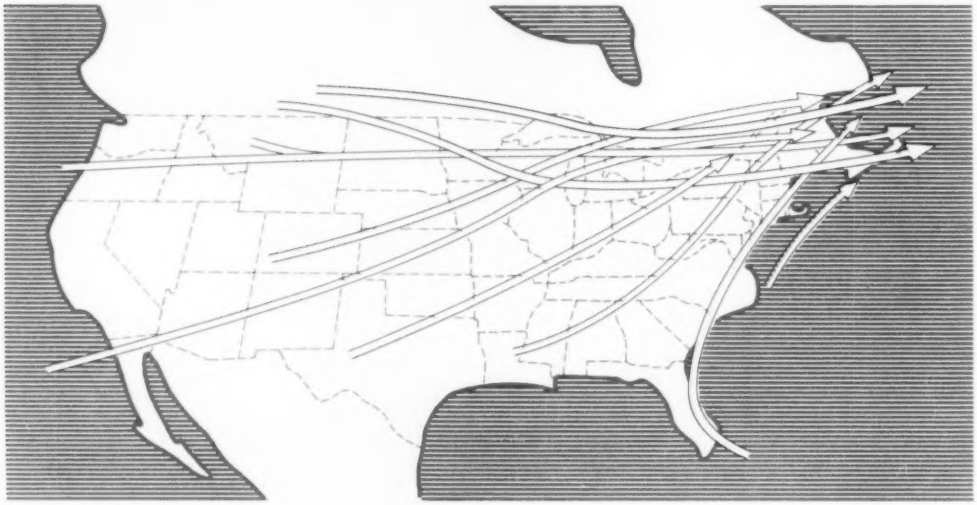
In the U.S., moisture-laden winds swinging north from the Gulf of Mexico are a major weather factor east of the Rockies. Less decisive, weatherwise, are the light, variable winds on the Pacific Coast at this season.

. . . borne on the winds

Winter winds . . .
like those of summer have as their mainspring the heating action of the sun. And this, in turn, is modified by the slow, seasonal shift in the angle at which the sun stands in the sky.

As a result, the northern hemisphere receives less heat in winter months, and wind patterns over the U.S. change. Winds from the West Coast, carrying their vapor loads, penetrate farther to precipitate their moisture as rain or snow. The northerly winds, which tend to predominate over much of the country, help drive temperatures down.

Sweeping across the country, major weather paths . . .



Rains over the U.S. come largely from "cyclonic" storms that travel generally from west to east but may start in the Gulf of Mexico, the Atlantic, or at almost any point on land. Earth rotation, solar heating, prevailing winds and ocean currents determine these major weather paths.

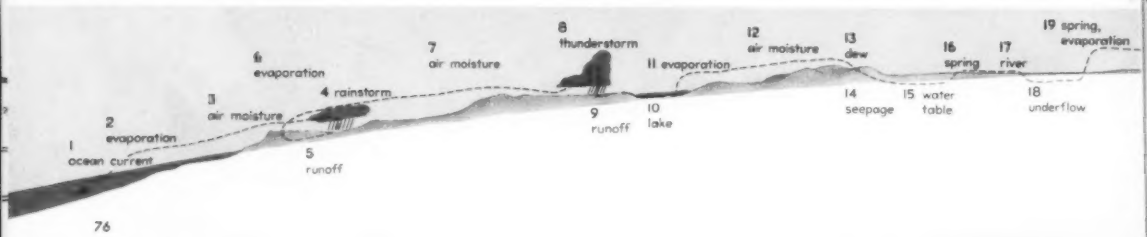
Cyclonic storms (not to be confused with "cyclones") result from interaction of southward-moving polar air masses and warm air masses moving up from the equator. The "fronts" formed create differences in barometric pressure—alternate high- and low-pressure areas. Surface winds spiral *out* clockwise from the h-p centers and *in* counterclockwise to the lows (diagram, right). Precipitation if any, occurs in l-p areas, depending on local topography. Thus east-moving moisture-laden lows may dump most of their water on the first mountain range they strike and the country east of the mountains may remain rainless.

Winds appear to come down from the lower stratosphere in h-p areas, pick up moisture on their way to the l-p area where they drop it and rise again to the upper troposphere and the lower stratosphere.

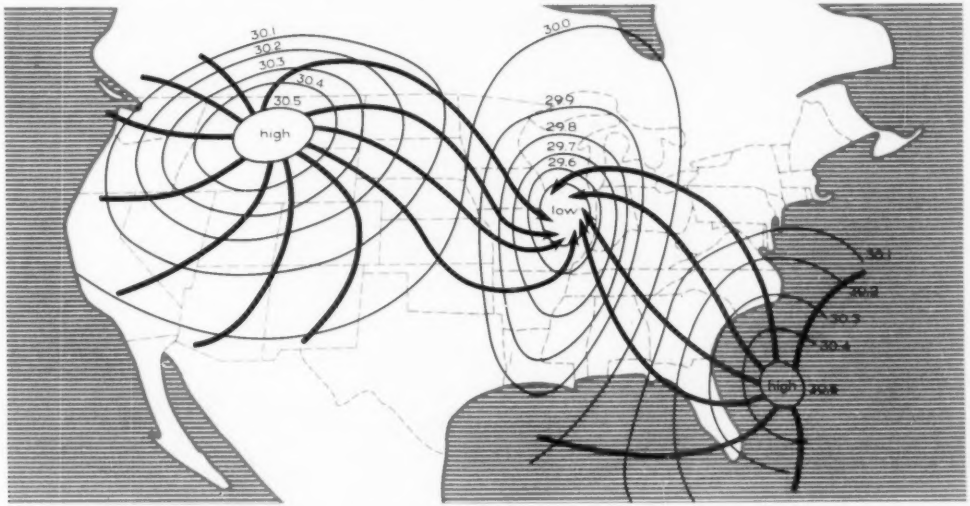
The entire pressure pattern moves across the continent, continuously changing shape and taking about three to five days for the journey.

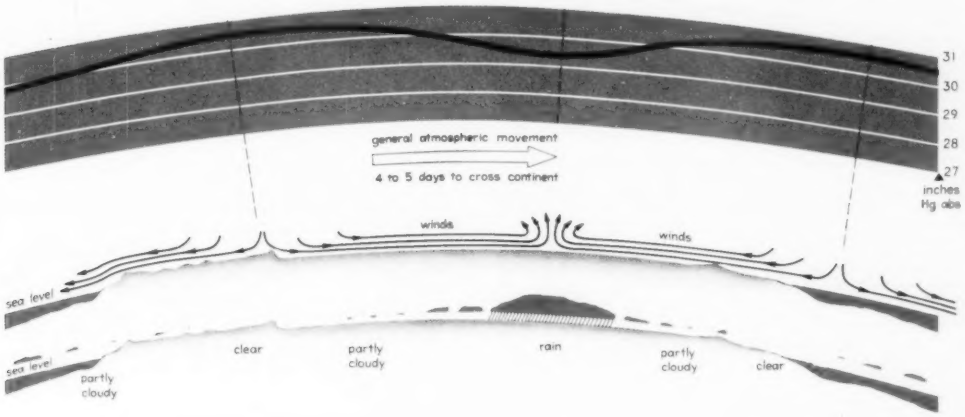
In looking at vertical sections of the typical cyclonic storm pictured opposite, remember that heights are grossly exaggerated. In proper scale, wind movements and clouds would be lost in the ground line. In other words, most of our weather occurs in a film of atmosphere no thicker than the thin outside skin of an onion when compared to the earth's diameter.

Coast-to-coast adventures of a vagabond water molecule

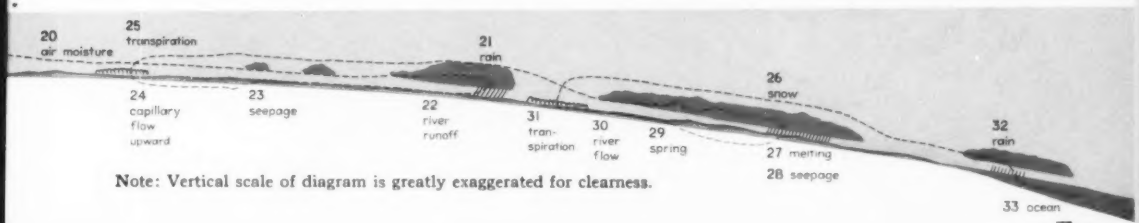


. . . decide where precious air-borne moisture spills





The world of water is full of incessant movement. Weather maps picture the broad shifts, average out the myriad details. To see what really happens let's trace, in numbered sequence below, the imaginary travels of a water molecule rising out of the Pacific. Its journey to the Atlantic may take only days, or it may take ages if the molecule is stored for a time on the way. As it works fitfully eastward, it may be part of crystal-pure water at one time, part of the food you eat, or part of sewage, at other times.

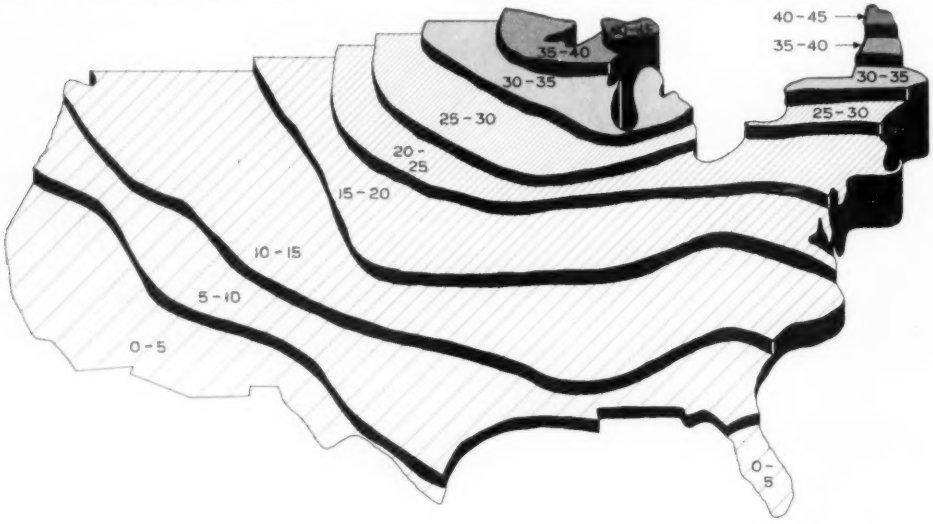


Note: Vertical scale of diagram is greatly exaggerated for clearness.

Cyclonic storms ranging over widespread areas . . .

Cyclonic storms exert strong effects on the climate of the lands they pass over. Sweeping across the U.S. from the west and south, they build up to a maximum number per year in the Northeast. This concentration of cyclonic storm paths over the New England states gives that area the vigorous and variable weather it enjoys.

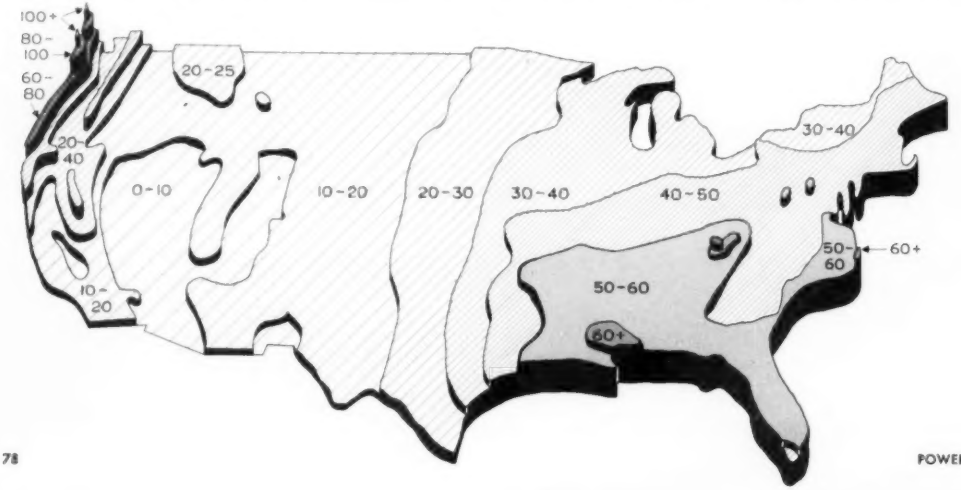
The Southwest has far fewer cyclonic storms, which partly explains its relative aridity. Yet the almost cloudless skies over this "bone-dry" country transport millions of tons of water as an invisible vapor moving eastward. This water doesn't fall on the southwestern states because there's no atmospheric cooling to condense it to rain drops.



. . . are chief contributors to regional rainfalls . . .

Over the entire U.S., "rainfall" averages 30 inches per year. This includes all forms of precipitation: rain, snow, hail, sleet and dew. Regional rainfalls differ enormously — from 160 inches a year in the Olympic Mountains of the Pacific Northwest to less than 10 inches in the Arizona-Nevada-Utah region. The map shows only average conditions over broad areas; rainfall in small localities may differ widely from the average of the area.

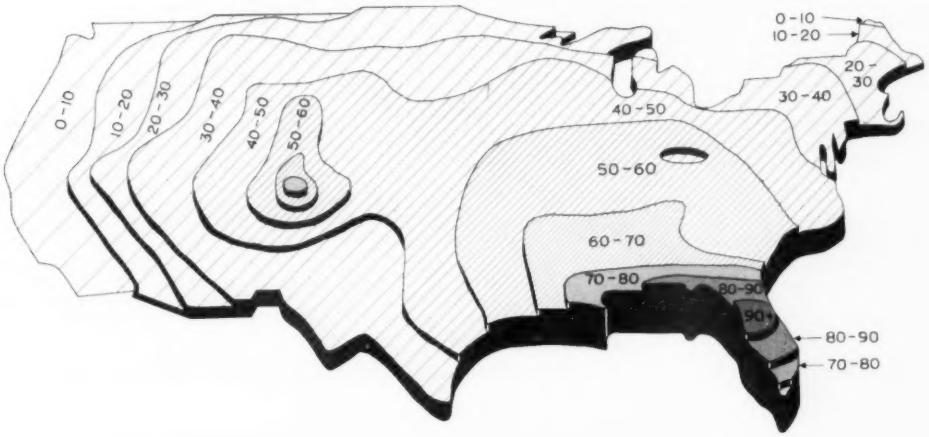
While regional rainfall figures reflect the importance of cyclonic and thunder storms, they also show that other factors — local topographic and atmospheric conditions — have a lot to do with how much rain spills and where.



. . . and the often-violent local thunder storms . . .

Thunder storms follow a localized pattern that is far different. But they, too, are important in the scheme of natural water supply. In some places, thunder-storm frequency is high where cyclonic-storm frequency is low, in central Florida and northern New Mexico, for example. Maine, on the other hand, experiences frequent cyclonic storms, few thunder storms. And the Pacific Coast has relatively few storms of either type.

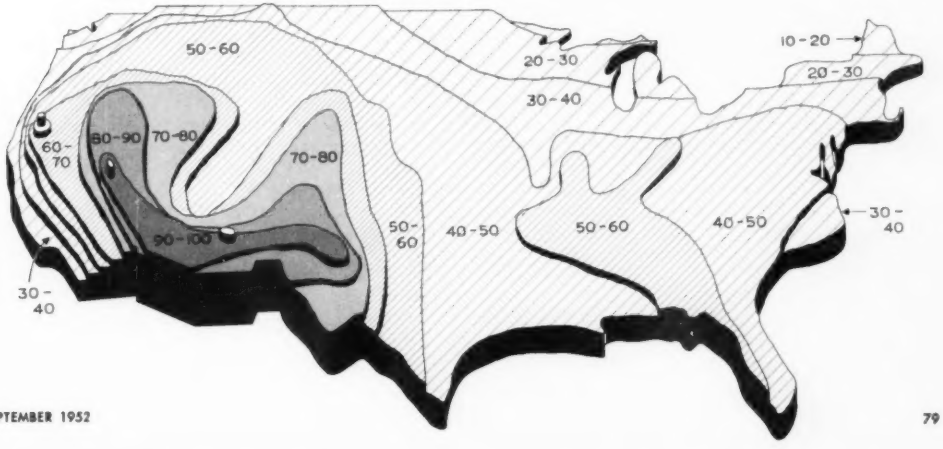
Meteorologists recognize several thunder-storm types. Most frequent is the convective storm, which develops rapidly, covers a small area, moves slowly and causes heavy local rainfall with strong down-drafts and ground squalls.



. . . but evaporation takes heavy toll in some areas

Almost three-fourths of U.S. rainfall rises again into the atmosphere, by evaporation and by transpiration from vegetation. This map gives a rough idea of regional tendencies by measuring average annual rate of evaporation from a free water surface. Thus it shows *ability* to evaporate water, if and as it occurs, not *actual* evaporation.

Rate of evaporation depends on vapor pressure of atmosphere, temperature, wind movement, altitude, topographical and geological features. Where high evaporation coincides with sparse rainfall, we find desert regions like those of the Southwest; where the reverse occurs, we find lush areas like the "rain-forest" of the Pacific Northwest.



Over long periods, weather forms definite patterns . . .

Usefulness of rain, especially for agriculture, depends on the season in which it falls. These bar groups show long-time distribution of monthly rainfall in selected cities. Each group adds up to 100%.

Patterns shift across the country, from the wet winters, dry summers of San Francisco to the dry winters, wet summers of Bismarck, N. D., and the relative uniformity of New York City.

The rain that stays on top of the ground is man's major water source

Of total U.S. rainfall, about 72% returns to the atmosphere by evaporation and transpiration. The remaining 28% moves toward the ocean as runoff and seepage. This is the only water really available for most of man's needs. In the U.S., hydrologists estimate, 12 to 15% of this earth-borne water is "used", less than 5% of all that falls from the sky.

Surface water—streams and lakes—is usually more plentiful and accessible than underground water, thus often gets first call. Of all water used in the U.S., about 80% comes from surface sources, only 20% from underground. To study the behavior of surface-water supplies, we need to look first at its basic unit—the *watershed*. This is a section of terrain—large as the Missouri Valley or small as a corner of Rhode Island—that slopes to a common point for drainage.

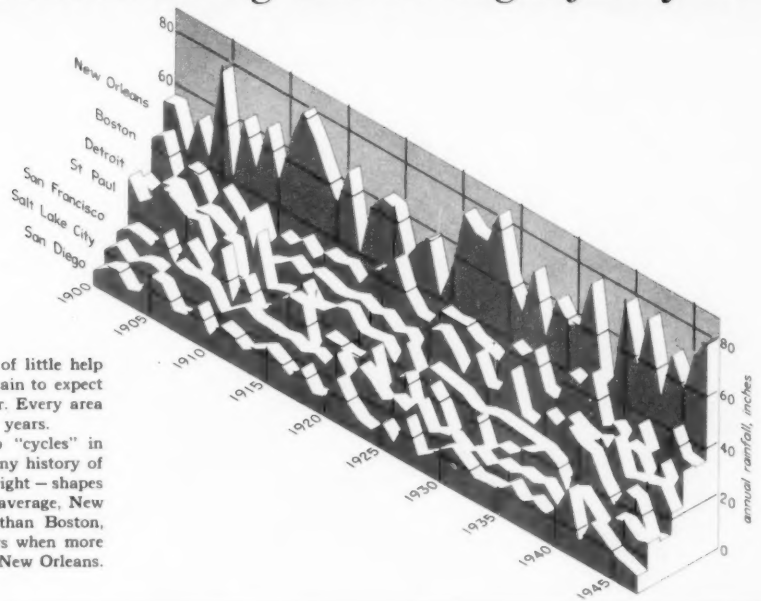
Rain drains over its surfaces into rills and brooks that join to form larger streams. The river of the example (facing page) may collect water from hundreds or thousands of square miles. How much water it collects and how regularly it flows depends on the weather and on the nature of the watershed's surfaces.

At best, rainfall is irregular, in some areas much more so than in others. The nature of the surface on which it falls can help to iron out this irregularity or can accentuate it. For example, rain falling on bare, hard surfaces runs off quickly. Heavy rains may then cause wasteful flash floods.

Vegetation and porous soil surfaces trap rain, regulate runoff. On such surfaces, however, evaporation and transpiration may be greater. While it is hard to evaluate the exact effect of a watershed's surfaces, it is clear they make a marked difference in surface-water runoff and river flow.

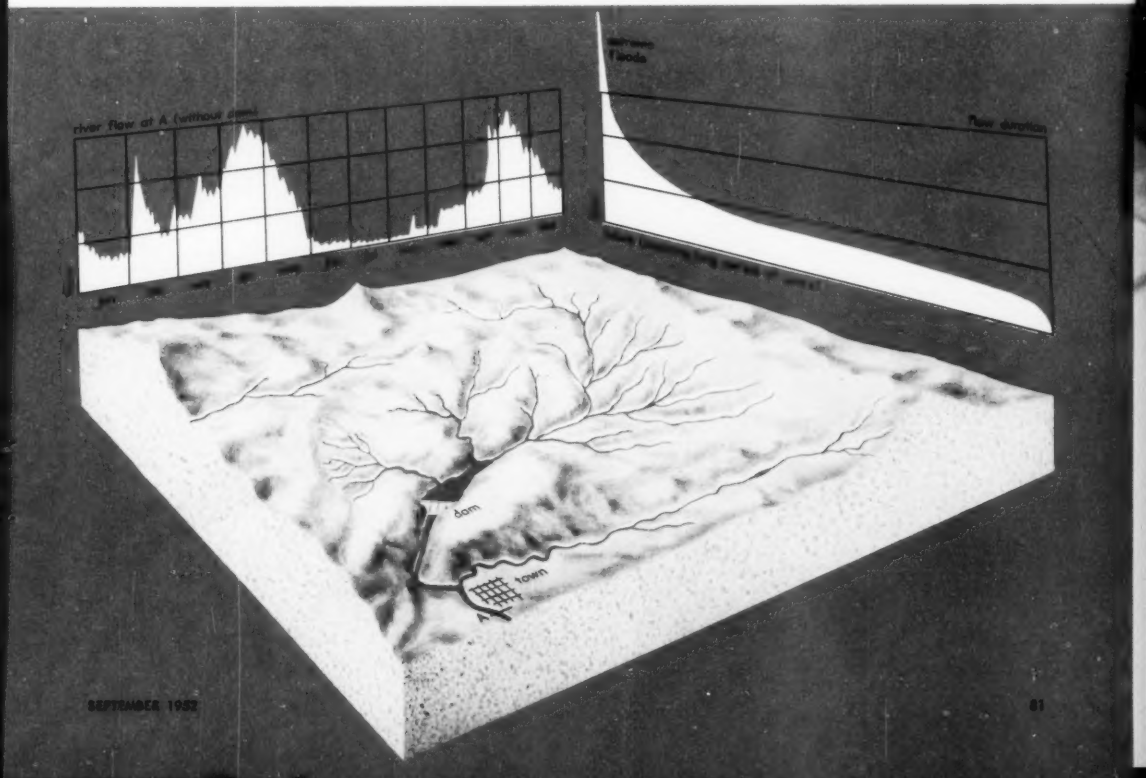
Our hypothetical river's flow seems highly irregular, yet it is actually more uniform than most. Flow-duration curve (*right*), with long-time averages of hourly flows arranged in descending order, shows that extreme floods have been rare. Information like this enables engineers to plan dams and other works to store rainfall and regulate river flow for man's use. Following pages deal with aspects of river regulation.

. . . but don't let the long-time averages fool you

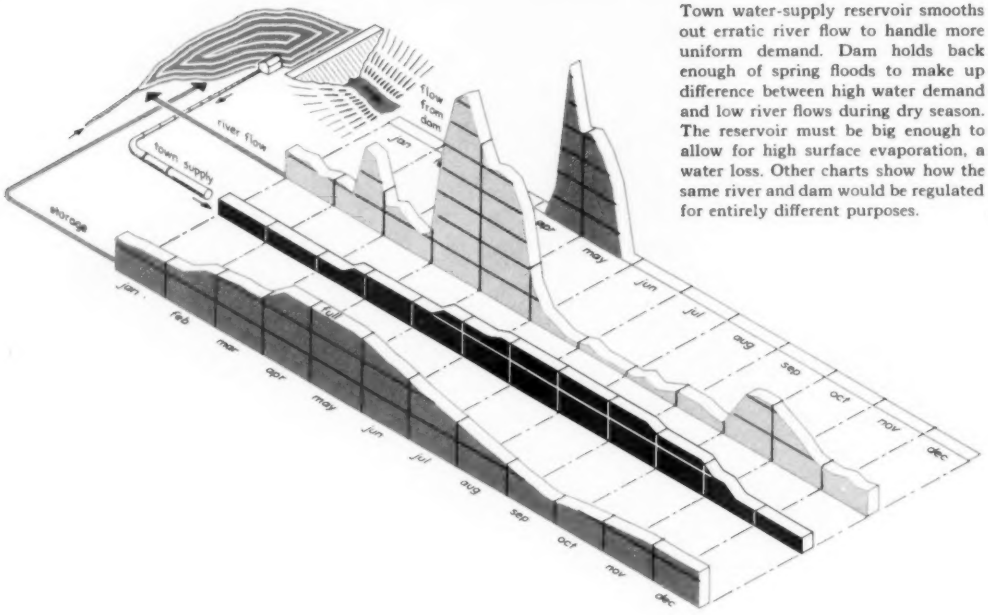


Long-time averages are of little help in predicting how much rain to expect in a given month or year. Every area has its "wet" and "dry" years.

Meteorologists find no "cycles" in recorded weather data. Any history of weather – like that at right – shapes up as a jumble. On the average, New Orleans is much wetter than Boston, but there have been years when more rain fell in Boston than New Orleans.

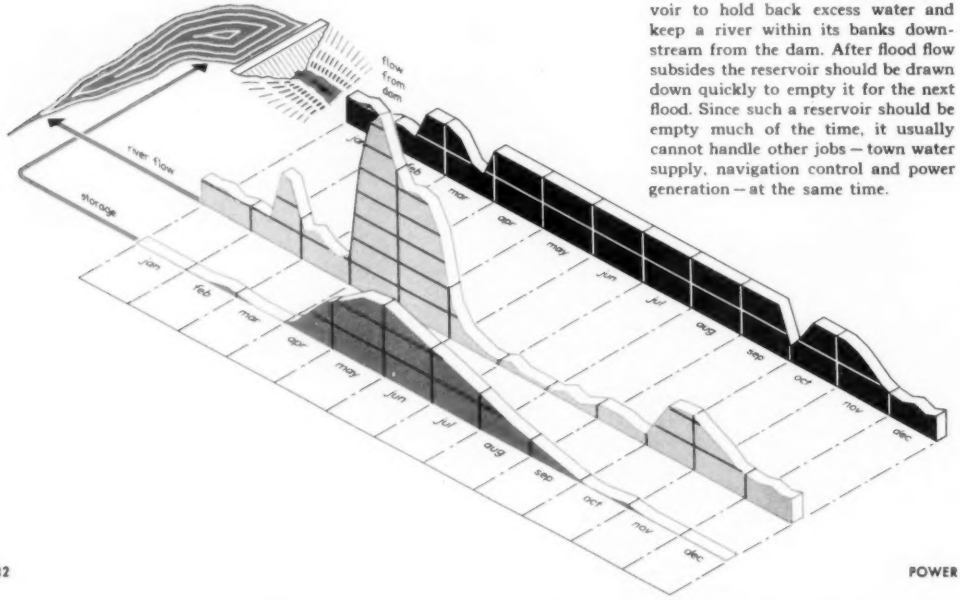


River control varies with objective: town supply . . .



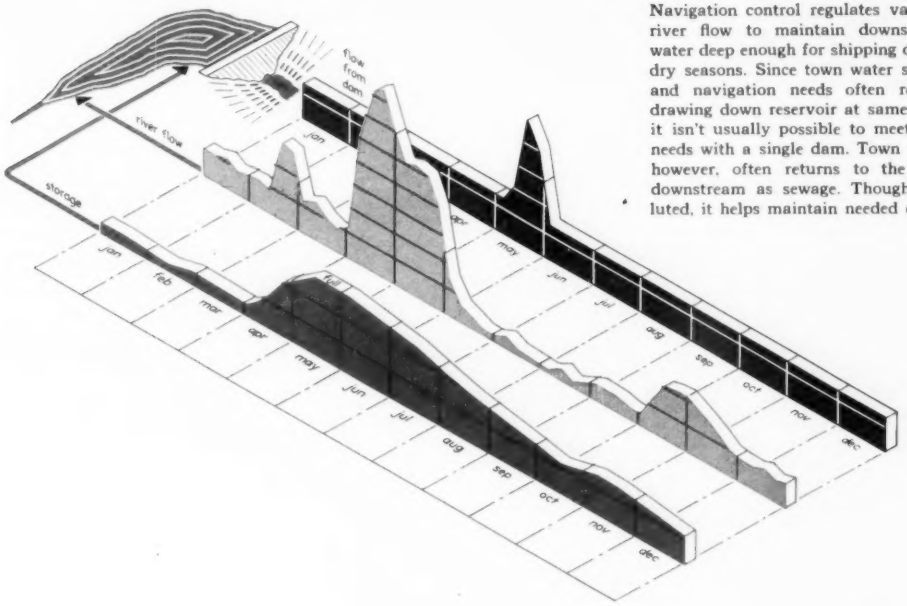
Town water-supply reservoir smooths out erratic river flow to handle more uniform demand. Dam holds back enough of spring floods to make up difference between high water demand and low river flows during dry season. The reservoir must be big enough to allow for high surface evaporation, a water loss. Other charts show how the same river and dam would be regulated for entirely different purposes.

. . . flood control, with an empty reservoir needed . . .



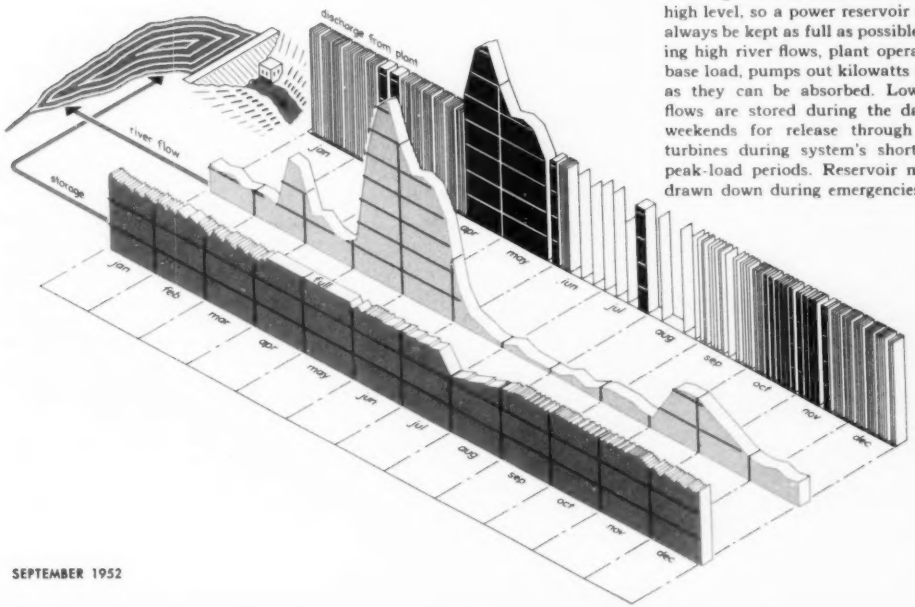
Flood control needs an empty reservoir to hold back excess water and keep a river within its banks downstream from the dam. After flood flow subsides the reservoir should be drawn down quickly to empty it for the next flood. Since such a reservoir should be empty much of the time, it usually cannot handle other jobs — town water supply, navigation control and power generation — at the same time.

. . . navigation, with downstream depth big factor . . .



Navigation control regulates variable river flow to maintain downstream water deep enough for shipping during dry seasons. Since town water supply and navigation needs often require drawing down reservoir at same time, it isn't usually possible to meet both needs with a single dam. Town water, however, often returns to the river downstream as sewage. Though polluted, it helps maintain needed depth.

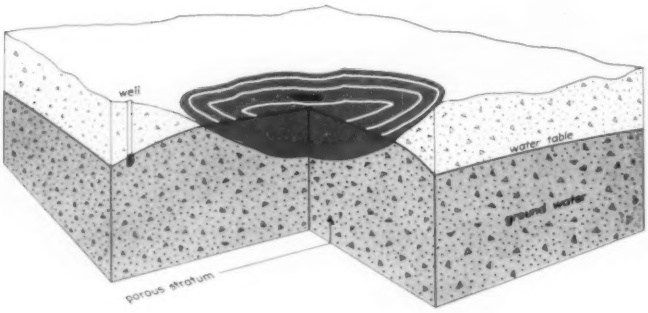
. . . or power generation, with full storage wanted



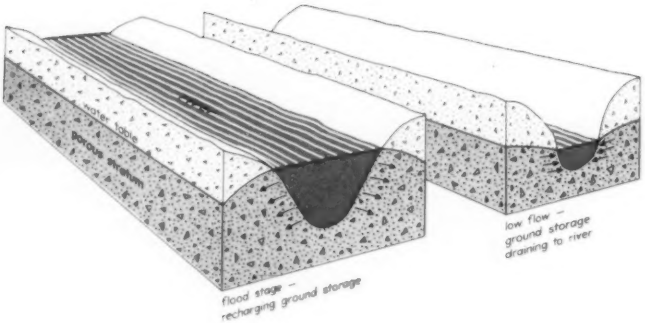
Power generation calls for water at a high level, so a power reservoir should always be kept as full as possible. During high river flows, plant operates on base load, pumps out kilowatts as fast as they can be absorbed. Low river flows are stored during the day and weekends for release through water turbines during system's short daily peak-load periods. Reservoir may be drawn down during emergencies.

The rain that goes underground also serves man . . .

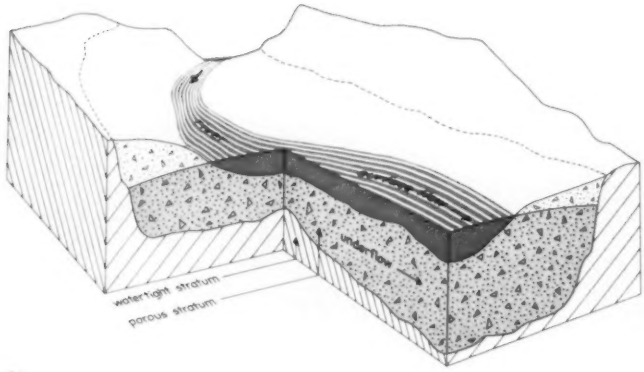
Depending on surface conditions, some part of rainfall seeps underground, working its way into porous strata. At an extremely slow pace, it flows underground, working its way always "downhill." What happens during its tortoise-like wanderings depends on topography, soil porosity and formations, other factors. At some lower level, it may come to the surface as a natural spring, may discharge into a lake, river or ocean. Or it



The level of underground water is called the *water table*. It is affected by many factors: rainfall, soil porosity and formations, rate of underground flow, rate of water removal by pumping are most important. The water table always meets a free water surface, sloping to it or away from it depending on the topography. To tap underground water, wells must be driven below the water table, which fixes height to which water will rise in well. Yield is greatest when well casing penetrates to bottom of water-bearing stratum.



During flood flows, rivers recharge underground water storage, raising the water table in surrounding porous strata. Conversely, when flow falls off greatly and river level drops, ground water seeps back into river, helps to maintain meager flow. Thus underground storage acts like a flywheel, absorbing some of excess flood water and giving it back during dry periods. Flood flows also help the absorbing action of river bottom by scouring it free of the silt that settles out during low flows, plugs "pores" of bottom.



In many cases, the river you see forms only one part of a complete water course. Below the surface river is a "ghost" stream flowing slowly through the porous deposits forming the river bed. This porous material may have been laid down by ice-age glaciers or by the river itself as it wore down mountains during past geological ages. Often the porous material fills a valley formed by water-tight rock.

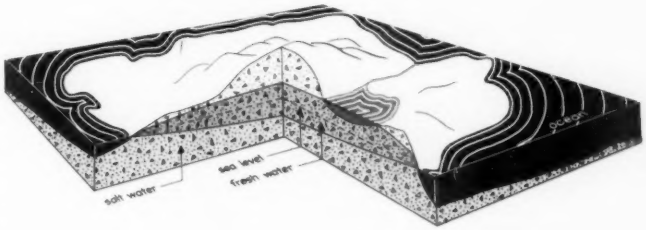
The underflow travels only a few feet per day while the visible river races on for miles. Yet the mass of water stored in the underflow is usually much larger than in the surface river.

. . . *when he knows how to tap its hidden resources*

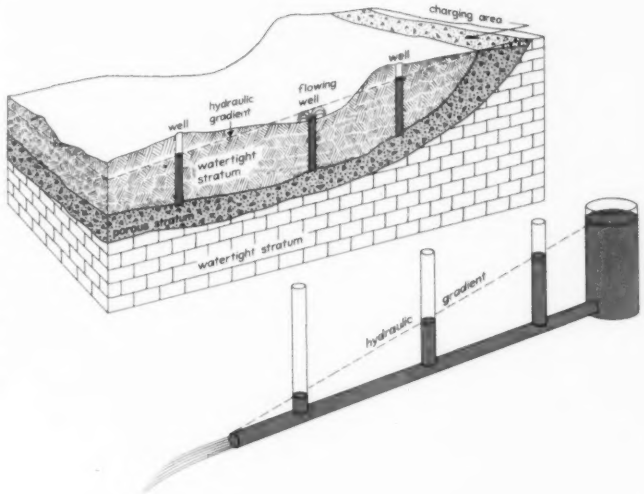
may end, its way blocked, in some underground storage.

Just as underground water may eventually become surface water, so surface water may go underground. In the Great Basin area (parts of Nevada, Utah, Idaho, Oregon and California) many rivers terminate in underground reservoirs, never reach the ocean.

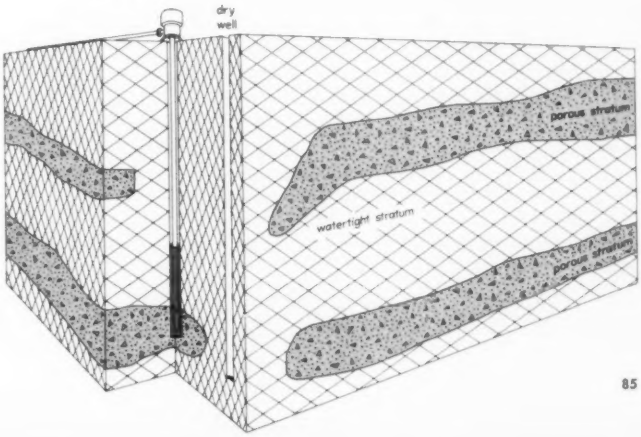
This invisible part of the world of water is, as we shall see later on, of great practical importance.



Island surrounded by ocean gives the simplest example of the water cycle. Vapor distilled from the sea by sun heat condenses into clouds and spills onto the island as rain. This filters into the ground under gravity action. Fresh water working down comes into equilibrium with salt water working in horizontally. The result is a fresh-water "lens," along the lower surface of which fresh and salt water tend to merge. Upper surface of the lens is the island's fresh-water table. Outer edges of the lens are at sea level.

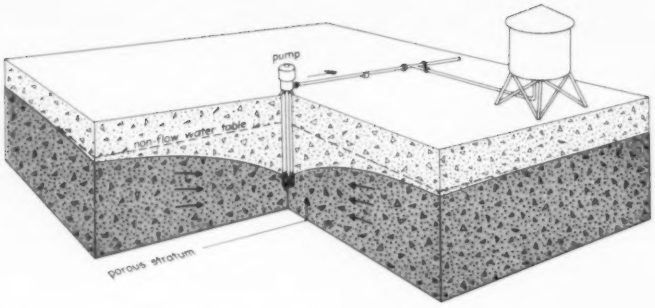


In laboratory model, height to which water rises in vertical tubes is given by line drawn from tank surface to open end of pipe. This is the *hydraulic gradient*. In nature, water falls on exposed portion of porous stratum and works downward between water-tight layers. Driving a well through top layer taps this water. Water rises to line of hydraulic gradient, forming an *artesian* well. If gradient line lies above the ground surface, water will spout free. Most natural springs are, in a sense, artesian wells.

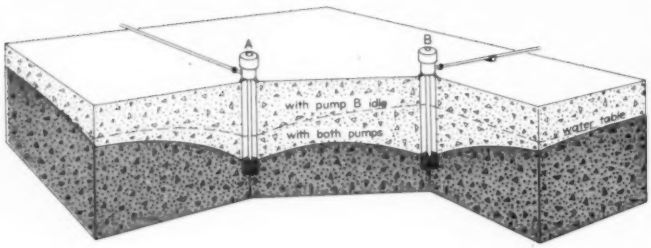


Ground water usually travels in porous strata separated by water-tight layers. Direction, shape and extent of porous strata can't be anticipated accurately so it is possible to drill a dry well right next to an active one.

Underground water may travel for miles before it reaches the point at which it is tapped; 50 miles is not unusual, and in the Dakota sandstones, water travels 300 miles underground. For large supplies, stratum tapped must have a large cross-section because of low natural flow rates. Houston, Texas, for example, draws from a 600-ft-thick section, 45 miles wide.



When a pump draws water from a well, level in the well drops, and water flows "downhill" from the surrounding ground. How fast it flows depends on the porosity of the water-bearing stratum and on the "head" between normal water table and the lowered level in the well. When rate of seepage into well balances rate of withdrawal, water level becomes constant. Result is a conical dip in water table around the well, called the *cone of depression*. If well is pumped faster, cone becomes deeper. Too fast a rate cuts yield.



With two wells next to each other, double cone of depression appears when both operate. Doubling the number of wells does not necessarily double the capacity. Because of limited rate at which underground water can flow, increasing the rate of pumping in a given area simply lowers the water table. This means deeper wells, higher lifts, and hence greater pumping costs. In the long run, amount of water withdrawn from an underground area cannot exceed what comes into it by underground flow from its charging area.

In the end, we are concerned only with water in relation to man. But we will better understand his water problems, as outlined in pages that follow, if we take a last look at the main facts of *hydrology* — water in nature. Briefly, what does nature give us to work with, water-wise?

Our globe and its atmosphere hold an inconceivably immense store of water. Nothing man has done, or can do, will ever make it more or less. But with the exception of a minute fraction, all the world's water wealth is in the oceans, and so polluted with the salt accumulations of millions of years as to be useless for most of man's needs.

Yet, as if to compensate, nature offers free distillation of salt water, plus transportation of the distillate thousands of miles from ocean areas to the heart of continental land masses. The distilling plant is fueled by the sun's rays. The transportation system is in the turbulent troposphere — the inner seven-mile layer of the atmosphere, the extremely thin film that holds all the world's visible weather.

From the troposphere, rain, snow and sleet fall in quantities far beyond man's needs. In the U.S., almost three-quarters of the total precipitation re-evaporates to the atmosphere, while a little more than one-quarter heads for the oceans, traveling over and under the surface of the ground. From this earthbound fraction, we meet most of our water needs, yet we use only some 12 to 15% of it.

Certainly, then, we must credit nature with providing ample water. It is only nature's timing and delivery that is imperfect. Rainfall varies from the lush abundance of the "evergreen" Pacific Northwest to the scarcity of the parched Southwest. And in any one region, the recorded total precipitation varies widely from season to season and from year to year.

Now we're ready to see why we have . . .

Water shortages in a land of plenty

To most parts of the U.S., nature brings ample average rainfall. Why then do we read of water shortages in major cities, find industrial expansion governed to an ever greater extent by water availability, spend vast sums on development of public water projects? Aside from local droughts, there are three main reasons for water shortages. These are discussed on following pages, summarized below:

Many and varied, our needs continue to increase rapidly

At the bottom of U.S. water problems, of course, lies the growth of our population. Yet far more important is the multiplying effect of the ever-rising living standard of that population. We demand more water for individual sanitation and comfort—by far the highest average per-capita usage in the world. And we demand of agriculture and industry more and more products and services in the making of which water is used, often in large quantities.

Needs run out of balance with supply in many areas

Neither water nor the demand for it are evenly distributed. Rainfall varies from section to section. Some areas enjoy plentiful surface-water supplies (streams and lakes) while others must literally "dig" for water. Differences in water wealth undoubtedly influenced the development pattern of the U.S., but many other factors were at work.

Because of these "non-water" factors, we find great concentrations of population and industry whose demands cannot possibly be met from strictly local supplies. And we find agriculture expanding in water-poor regions. The answer in both cases lies in large-scale diversion of water from regions of surplus to regions of need.

We must pay for past squandering of water resources

As we have others, we have abused our water resources. In many areas, we've "mined" underground supplies, temporarily depleting some, permanently ruining others. By unchecked dumping of wastes, we've polluted many of our surface-water sources, making them unusable for most purposes. And in numerous other ways, we've upset delicate natural balances in the world of water.

Fortunately, water resources are being replenished constantly. If we can learn to work with our environment instead of against it, we'll find we have more water available to us than we seem to have at present.

Water-use picture seems simple but isn't

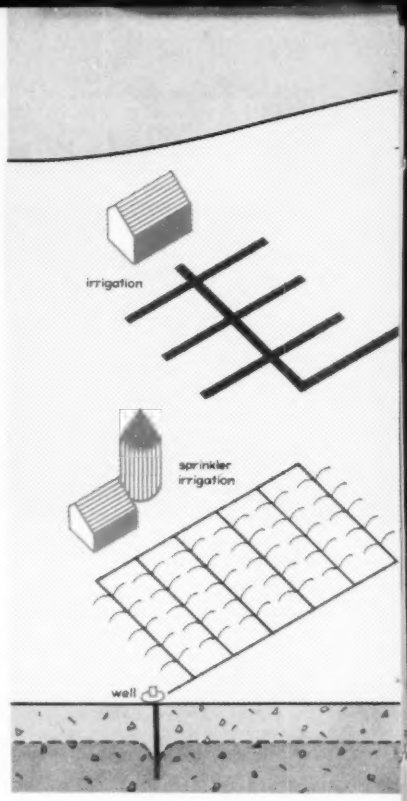
In the strict sense, water is never lost. No matter what we do with it, water finds its way back into the natural cycle. It might thus be argued that it makes no difference what water is used for, or how it is used. Actually, what happens to the water is a matter of extreme importance because various uses "borrow" water from the natural cycle for longer or shorter periods and because there are often significant differences in how and where the water is "returned." These differences may be enough to upset local supplies. The drawing, right, pictures typical uses and their differences.

To start with, many uses involve little or no disturbance of nature's cycle. Water in the lake and stream pictured goes its way unaffected by the sailing and swimming of recreation seekers, or by the passage of craft navigating its lower reaches. Natural water supplies like these breed fish and support waterfowl and other forms of wildlife. And we mustn't forget that most of our farms depend on rainfall and hence "use" water without taking it from the natural cycle.

Many uses represent only the most trifling borrowings and do not significantly affect the immediately available water resources of the region. Water merely passes through turbines of the hydro plant and condensers of the steam power plant. Hydro use changes only potential energy. Condenser use, like many industrial cooling processes, changes only temperature.

Apt to be critical are the uses that reduce the water immediately available to the region. Much of irrigation water, for example, goes back to the atmosphere by evaporation and transpiration. It may, or may not, return to the region as rainfall. Thus the farmer using well water for sprinklers may cause a net reduction in the region's groundwater supplies. The factory owner who installs a recharge well returns much of his withdrawal to essentially the same place in the cycle and at nearly the same time.

The state in which the water is returned also makes a big difference. Our municipal system draws water from the stream and the sewer system discharges back into it. If these wastes, and those of the industries using the stream, are treated, there's little net change in the region's available water. But if wastes aren't treated the entire downstream flow may become badly polluted and its usefulness diminished or even completely lost. This reduces the region's supplies.



Booming demands put strains on water resources...

Anyone who has ever been thirsty knows, if only in a narrow sense, what water means to human life. Without it we die. And without it our livestock and fish die, our food plants wither.

Many Uses. Beyond these vital necessities, water serves in many ways to better our lives. It makes possible personal cleanliness. It flushes away the wastes of cities and protects against fire. Unseen, water helps refrigeration to preserve our foodstuffs and air conditioning to make us comfortable.

Life's pleasures owe much to water. Nature's waterways offer swimming, boating, sport fishing. Water supports wildlife, valuable for sport as well as food, and the vegetation that makes our surroundings livable and attractive.

From earliest times, waterways carried the commerce of nations and falling water supplied power. And industry found water valuable as both solvent and coolant. Now, new products and processes make industrial needs vastly greater than ever before.

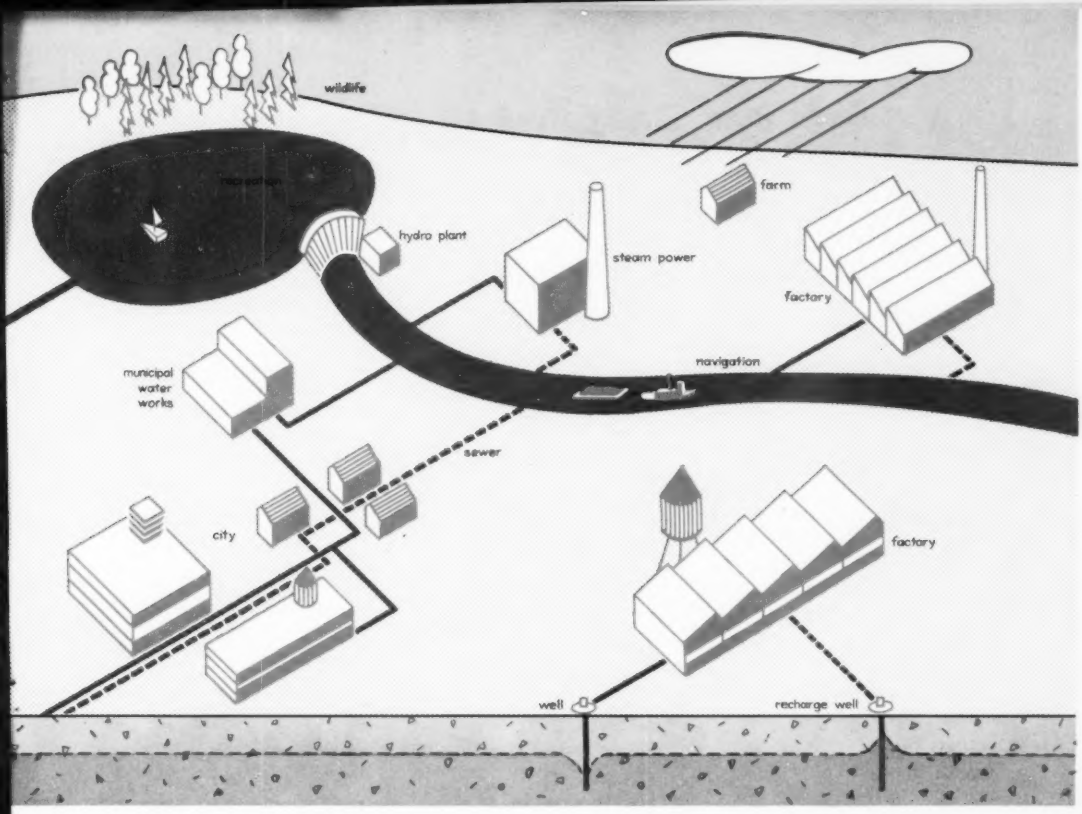
Growing Demand. Water enters into so many aspects of civilized life, and in so many ways, that it's easy to see why it has become a problem in the U.S. Our growing population with its sharply rising living standards obviously needs more water.

The quantities involved are enormous. The water "price" of a bushel of wheat is 30 tons. Of a ton of steel, 100 tons. Into the making of a pound of rayon goes as much as 100 gallons of water.

For all that such figures give us an idea of the magnitudes we face, they must be taken with extreme caution. The reason: We don't have any real agreement on what we mean by water "consumption." In one steel mill each gallon of water serves 46 processes before final discharge. Is the consumption per ton of steel the sum of all these uses? Or is it the net amount taken into the plant? Such differences in water "accounting" make published figures of industrial use vary widely, even for the same process.

Similarly, agricultural figures usually include water from all sources – rainfall, irrigation, reserves in the soil. Yet only the part not automatically supplied by nature is really of concern in most water questions.

Use Defined. Various agencies involved seem to be headed toward a definition like this: *Consumption* means taking water from a source (surface or ground)



...tend to emphasize conflicts among varied uses

and not returning it, as a liquid, to the same or a nearby source. Water that is returned in badly polluted form may also be said to be "consumed".

Such a definition takes rainfall out of agricultural figures—it isn't drawn from a surface or ground source. But much of irrigation water gets counted because it returns as vapor to the atmosphere and may be lost to the immediate region. And this definition brings industry figures into line by giving credit for re-use and charging only for the net amount withdrawn from local sources.

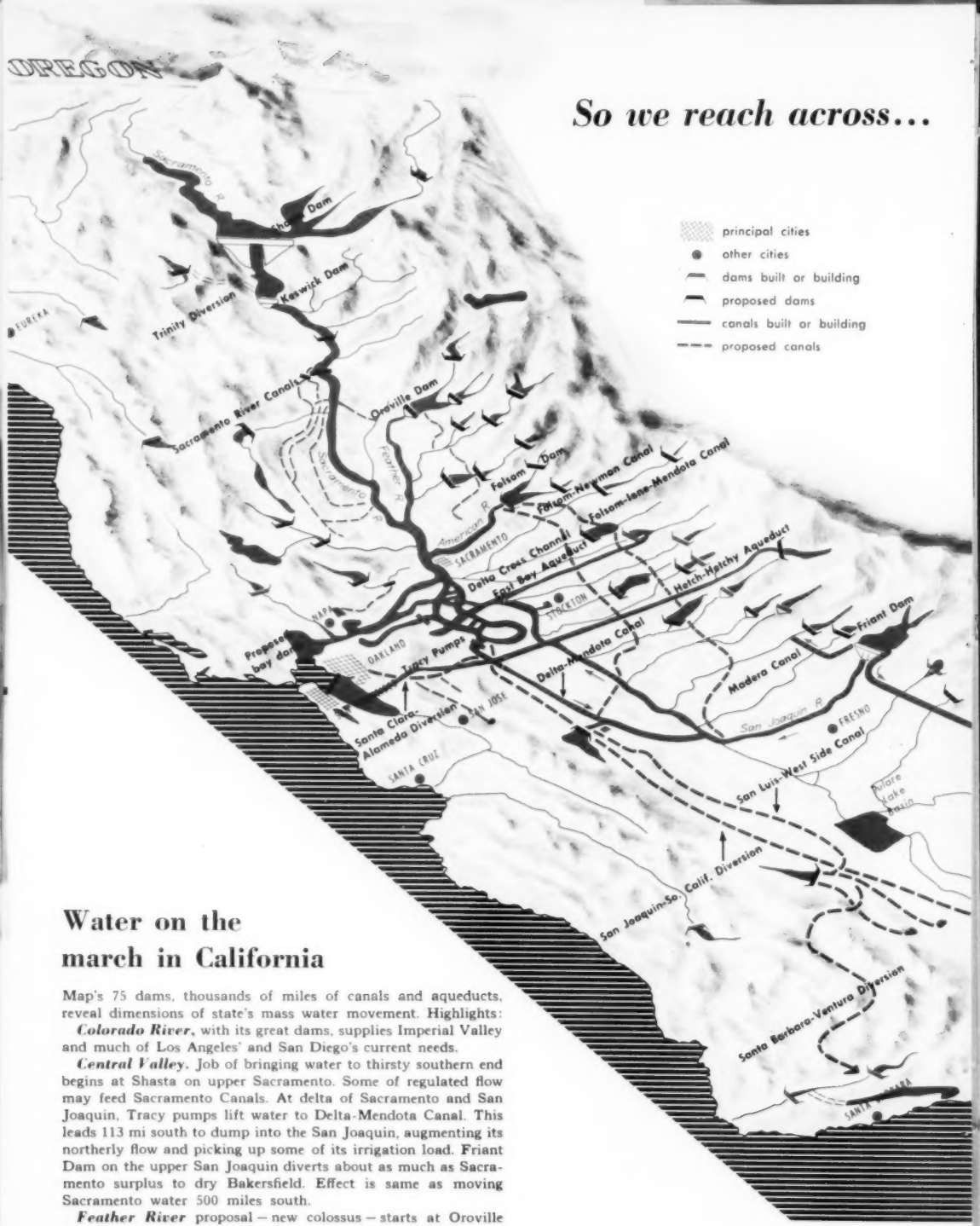
Public Supply. Many estimates attempt to show national needs by broad classes—public supply, agriculture, industry. What are probably the best current figures* put output of public water-supply systems at 14 billion gallons per day. Such systems, usually local, draw on reservoirs, wells, or both. Since segregation of use is rarely possible, entire output is normally treated to potable standards, although only a fraction is used for drinking. Public systems can exercise the right of eminent domain.

**Industrial Water-Use Task Force Report,* American Water Works Assn, Kansas City, Kansas, May 11-14, 1952

Industry. Although it takes about half of public-system output, industry meets most needs from its own sources. These are protected by riparian rights along streams and property ownership over ground sources. Industry itself produces about 81 bgd.

Agriculture. Estimates put rural use (farmsteads) at about 5 bgd. Biggest user of all is irrigation—about 100 bgd. Some irrigation systems have been privately or cooperatively developed but most recent ones have been government sponsored. Land ownership in irrigated areas usually carries "water rights."

Water Patterns. It's easy to visualize the rival claims of these uses in regions short of supplies. Where non-consumptive uses fit in is less obvious. To see their position, often important in water controversies, remember that water pervades the natural environment. Each time the water pattern of an area changes—swamps are drained, industry grows, navigation is extended, irrigation is developed—natural balances are upset, vegetation, fish and wildlife are affected. Such changes may bring into conflict lumbermen, fishermen, ship owners, sportsmen, etc, make finding a satisfactory answer just that much tougher.



Water on the march in California

Map's 75 dams, thousands of miles of canals and aqueducts, reveal dimensions of state's mass water movement. Highlights:

Colorado River, with its great dams, supplies Imperial Valley and much of Los Angeles' and San Diego's current needs.

Central Valley, Job of bringing water to thirsty southern end begins at Shasta on upper Sacramento. Some of regulated flow may feed Sacramento Canals. At delta of Sacramento and San Joaquin, Tracy pumps lift water to Delta-Mendota Canal. This leads 113 mi south to dump into the San Joaquin, augmenting its northerly flow and picking up some of its irrigation load. Friant Dam on the upper San Joaquin diverts about as much as Sacramento surplus to dry Bakersfield. Effect is same as moving Sacramento water 500 miles south.

Feather River proposal – new colossus – starts at Oroville and upper dams. At the Delta, near Tracy, a conduit would take off for the more than 500-mi run down the valley and over the mountains to the extreme southern end of the state.

Other Proposals: More dams, new canals in the valley network. And dams across Frisco Bay to make two fresh-water lakes.

...the long miles to bring water to thirsty fields...

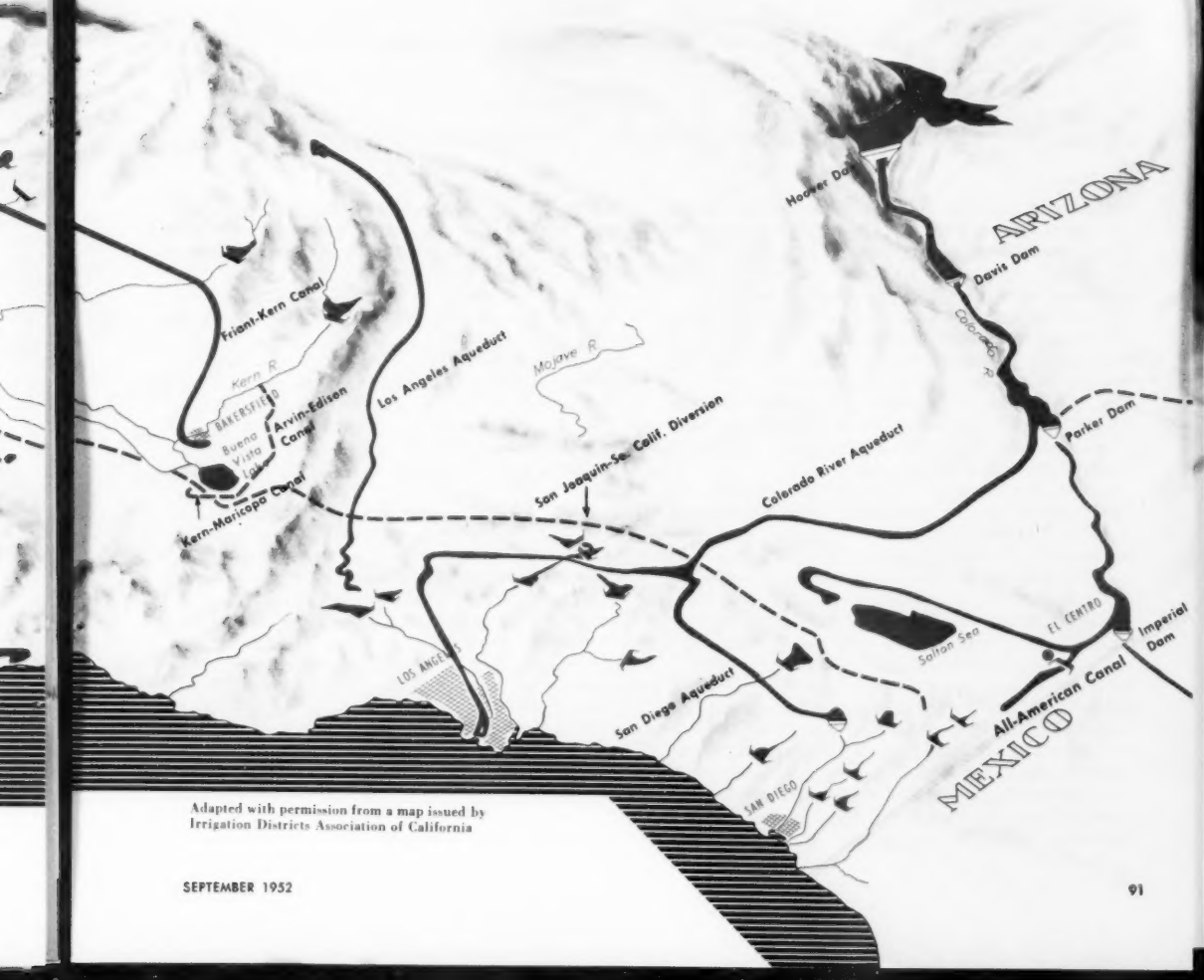
Nature often confounds man by giving him plenty of water but not where he wants it. So, even before the Romans built their magnificent aqueducts, men were moving water from areas of plenty to serve concentrated demands of irrigation farming, and city populations. And just in the past few decades, we Americans have become the greatest builders of dams and waterworks in the history of the world.

California Problem. The proofs can be found all over the West, but nowhere more plentifully than in California. That state's water problems arise from the simple fact that two-thirds of its population is in the heavily agricultural southern half, which receives only one-third of the rainfall.

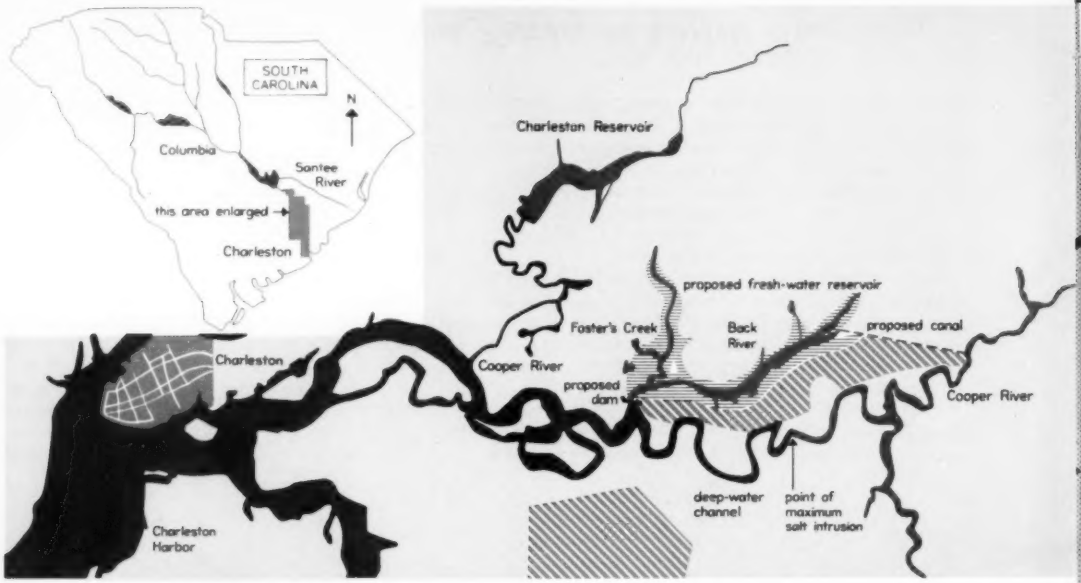
Coupled with this fact is another—most of California's rain falls in winter months. This makes farming on the rich soil dependent on irrigation during summer months. Here is another phase of the water problem—not only must water be moved in *space*, from where it is to where it's needed, but it must usually be "moved" in *time* as well. This means storing it when nature gives freely and releasing it when nature gives grudgingly or not at all. California's water history is a long battle to lick these two problems.

Ground Water. Early irrigators tried to lick the "time" problem by drawing on ground water in summer, but, unassisted, it just wasn't enough. So began the era of mass movement. Much of this has served to restore ground sources and today California uses some 40% of all the ground water used in the U. S.

Typical of the state's recordbreaking water transfers is the Central Valley project. In this 500-mile long and 50-mile wide valley, the Sacramento flows south and the San Joaquin north. They join to flow



Adapted with permission from a map issued by Irrigation Districts Association of California



...to our ever-growing metropolitan regions, and...

to the Pacific Ocean through a gap in the coastal range.

Central Valley Project. The objective might be stated thus: Move excess rainfall of the upper Sacramento 500 miles south to thirsty Bakersfield. And that, in effect, is what the project does.

Giant Shasta Dam, and others on the Sacramento, store seasonal excesses and regulate river flow. Near where the Sacramento turns west to flow into San Francisco Bay, part of its water is diverted to the Delta Cross Channel. Then the Tracy pumping plant, second largest in the world, lifts it to the Delta-Mendota canal running more than 100 miles south to the big bend of the San Joaquin.

By joining the northerly flow of that river, the excess from the Sacramento releases some San Joaquin water for transfer further south. The Friant Dam and its canals do this, supplying the Bakersfield area.

Never Enough. To the stranger, seeing the wonders of the famous dams on the Colorado, the long aqueducts to Southern California, the not yet completed Central Valley project, and the host of smaller dams and canals, it would seem that California's water problems are solved. To the Californian, confident of his state's future, this is only a beginning. On tap now is the Feather River project—something like 1200 million dollars worth of dams, canals, pumps and tunnels to carry water from the Feather, a tributary of the Sacramento, nearly to the Mexican border. The main section, the San Joaquin-Southern California Diversion, will be 567 miles long.

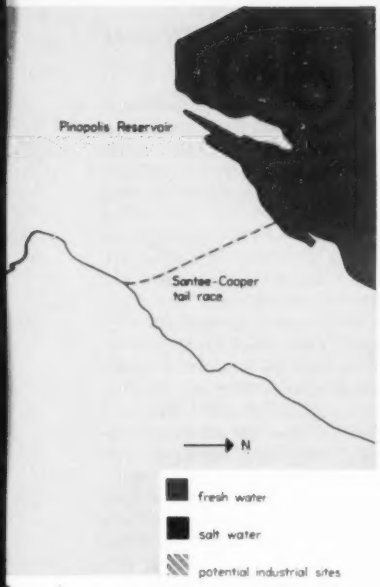
But that's not all. Californians talk excitedly of 4-mile-long earth dams across the arms of San Francisco Bay. These would form two fresh-water lakes connected by a canal. All streams flowing into the bay would then discharge into fresh water, and water now needed to keep salt out of the delta country could be used for other purposes.

And they also talk of bringing water from the Columbia River, something like 1150 miles from Southern California. A dam near the river's mouth would divert water after it had served all purposes.

City Problems. Some of our cities are fortunate in having large lakes, streams or underground sources available to them. Others, particularly tidewater cities, are not so fortunate. In each, the story has been much the same: Wells and local reservoirs met early needs but soon the city fathers had to reach out into the surrounding country for additional water. Some have had to reach again and again, each time farther.

New York forms a classic example. First, public supply came from wells, later from reservoirs within the present city limits. These soon proved inadequate and then began a series of large-scale water developments that still continues, barely abreast of demand.

First stage was the famous Croton development just north of the city. Then it was necessary to reach still farther north, on the other side of the Hudson River, to the Catskill mountains. Now New York taps the upper reaches of the Delaware River, in a program that is still expanding.



Charleston, S.C., develops low-cost supply

Like many cities, Charleston, S. C. needs additional water supply for industrial expansion. Unlike most others, though, Charleston is fortunate – in having possibilities for water development in its own backyard and in having the vision to exploit them.

If present plans go through as expected, Charleston will increase its water potential by 2500 million gallons per day, at an estimated cost of only $3,000,000. And it will get this fantastically "cheap" water next door to available industrial acreage on the Cooper River's deep-water channel.

Geography Helps. Along the Cooper, and between it and its tributary the Back River, there is plenty of land ripe for industrial development. But the Back River is brackish, and salt penetrates up the Cooper just about as far as it's navigable. Only a few miles of swampy lowland separates the source of the Back River from the salt-free upper reaches of the Cooper. Swollen by fresh water diverted from the 15,000-sq-mi Santee watershed, the Cooper's flow averages above 10 billion gallons per day. To A M Field, industrial developer, goes credit for seeing what could be done with this setup.

How It's Done. Briefly, the scheme proposed by Field and worked out by the engineers, involves: (1) A simple earth dam at the lower end of Back River, (about one mile above its junction with the Cooper) to keep salt out, create a fresh-water reservoir. (2) A 3½-mile diversion canal across the lowlands to connect the Back with the Cooper's fresh upper reaches. Then, as new industry moves in and draws water from the reservoir, it will be replenished from the Cooper's flow. Less minor losses, industry will put back into the Cooper what it takes from the reservoir, maintaining the Cooper's flow to check further salt intrusion.

Consultants on the job—Ford, Bacon and Davis—say that never before has a city been able to develop so much water potential at so little expense.

...to new and greatly expanding industrial centers

Incodel Plan. Four states—New York, New Jersey, Pennsylvania and Delaware—are now trying to work out equitable ways to bring the Delaware River and its tributaries into an over-all plan. Engineers of the Interstate Commission on the Delaware River (Incodel) expect the development to produce 2000 million gallons per day at a cost of close to $870 million (compare with more fortunate Charleston, above). Although cost is high, benefits are correspondingly large for many cities in the area.

First stage of the plan ($565 million, 15 years) would serve metropolitan New York and northern New Jersey communities, bringing in about 465 mgd.

Second stage of Incodel would come into effect as needs dictate. One step will provide water for Philadelphia when it needs it, or when it decides to switch to upland sources instead of present lower Delaware and Schuylkill supplies. There are two different schemes but in either case a conduit would take water to the southern New Jersey metropolitan district from Trenton to Camden.

Full regulation of Delaware River flow is expected to help overcome pollution from the Lehigh, which flows into the Delaware, and to check salt intrusion that now occurs in the lower Delaware.

Not Clear Sailing. Right now, New York, New Jersey and Delaware have approved the compact. Pennsylvania wants to improve low flow rate of the Delaware, but wonders if its share of costs is too high. So the plan is temporarily stalled, pending results of an independent study by Pennsylvania. Meanwhile New York is working on the diversion allowance of 440 mgd granted by the Supreme Court in 1931, and has petitioned for more (up to 800 mgd).

Other Cities. On a smaller scale, the same reaching out for additional water goes on in other sections of the country. Boston has just completed the $1.7 million Blue Hill Reservoir and the 15-mile pipeline of the Chicopee Valley Aqueduct. Baltimore is putting to work the recently finished 17-mile $23 million Patapsco water tunnel. And so it goes.

Industry Too. As with the great public water systems, so also does private industry find it necessary to reach across the miles for water. Down in Florida, the St Joe Paper Co is hard at the job of digging an 18-mile $2 million canal to bring fresh surface water to its Gulf Coast mill. An expanded demand of 30 mgd will be too much for their present underground water sources.

And industries have joined forces for water development (see also p 95). A few years back, at Texas City, Pan-American Refining Co and Carbide & Carbon Chemicals Corp set up a subsidiary, the Galveston County Water Co. It built a 28-mile canal to the Brazos River, capable of a flow of 275 mgd. A reservoir to store 2.75 billion gallons completed the job.

As our water demands continue to rise, we shall see more of this "stretching" for water. And we'll see more of the practices discussed on the following pages—practices aimed at making better use of what we have.

With engineering and law, we make a start on...

The big water development projects get the headlines. But, in many places, supplies are being augmented by more intelligent use of what's right at hand, and by correcting past water-supply mistakes.

Many shortage troubles turn up in areas dependent on ground water. Principles of water movement underground are by now well known (pp 84-86). Oddly enough, we often fail to recognize them in practice. And, even more surprising, we tap underground sources without really knowing much about their nature and extent. In most cases, the answer lies in better engineering. In some, it must be backed by law.

Water Table Drops. Louisville's World War II experience makes these basic points clear. This Kentucky city enjoyed rapid growth. Pumping from its wells rose to 75 million gallons per day compared to 37 mgd prewar. Water table dropped until yield of some wells fell to about one-quarter normal. Then Louisville called in the U.S. Geological Survey.

They first mapped the water-bearing layer (*aquifer*), then studied its permeability and rate of natural recharge. This proved to be 40 mgd and it was clear that Louisville was living far beyond its "water income." Fortunately, the city didn't have to retrench; the geologists found that sands near the Ohio River were highly permeable and recharge by infiltration to wells in that area would be more than enough. If such a study had been made earlier, wells could have been put there in the first place.

On Long Island, salt-water intrusion threatened serious trouble some years ago. The answer there combined engineering and law. As a whole, the Island has ample water. The eastern end uses relatively little but the western end, part of New York city, pumps heavily. Pavement and buildings cover much of the area, so natural recharge rate is low.

Salt Intrusion. As long ago as 1933, underground water level got as much as 30 ft below sea level. The usual fresh-water barrier was no longer there and salt water began to seep into the aquifer.

The state government stepped in, passed a law requiring all users of 100,000 gallons per day in affected areas to secure permits. Permit holders had to return unpolluted water to recharge wells after use. In addition, wells were drilled close to the shore and fresh water pumped down. The purpose was not to recharge the aquifer but to erect a fresh-water barrier between salt and lower ground water.

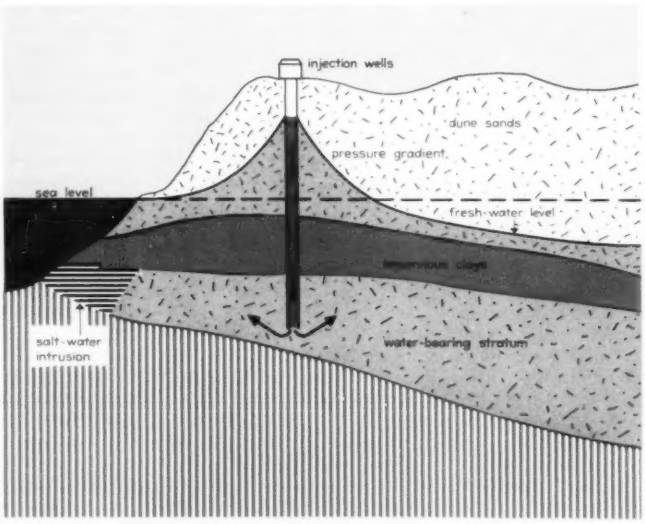
These steps largely cured the trouble on Long Island. Today, a similar situation confronts an area south of Los Angeles and inland from Manhattan Beach. One of several suggestions for checking salt-water intrusion is use of shore-line injection wells.

Other Pollution. Salt intrusion is a form of natural pollution. Man-made pollution also attacks underground supplies. Baltimore has had to cope with both. Years ago, salt water from Chesapeake Bay and the Patapsco River seeped in and contaminated the then-used aquifer. But below this was a rock layer and an artesian reservoir. Drilling down to this reservoir

Fresh water repulses salt

Excessive pumping from coastal-region wells may upset the pressure balance between fresh water and salt (p 85) and allow salt water to intrude. In the situation pictured, *right*, there are two water-bearing strata with a water-tight layer between. Pumping from the lower stratum, the main one, has depleted it faster than nature can recharge it. So salt water is beginning to encroach. If allowed to continue, it will make lower layer useless.

An idea sometimes used in such cases is the driving of *injection* or *recharge* wells close to the shore. These set up a fresh-water "seal" to hold back the salt water. Here, flow into the lower layer restores the pressure balance there. Pierced upper casing of wells builds up a pressure gradient or reverse cone of depression in top layer. Such attack close to the seat of trouble usually gives most effective control, is apt to be most economical of water.



...undoing the water-supply errors of the past...

brought in needed supply; the problem seemed solved.

But pollution troubles cropped up again in new guise. Copper smelters dumped acid wastes on the ground. No one saw any harm in it—percolation would only contaminate the unused shallow aquifer. Unfortunately, acid concentration built up in the shallow upper layer and ate into casings of abandoned artesian wells. Water from the upper level could then flow into the artesian reservoir below.

As soon as salt began to show in artesian wells, the cause was suspected. Today, all artesian wells, even abandoned ones, are kept pumping to prevent polluted water flowing down. This works so far.

More Recharge. Natural recharge sets the top rate at which you can pump from an underground source. If you pump faster, the water table drops. You then face a choice: cut down consumption, or find some way to step up recharge rate. For many, the latter has proved a practical answer.

What happened in the South Amboy area of New Jersey shows what can be done. It's particularly interesting because the problem was worked out cooperatively by the leading industries of that section.

When National Lead Co put up its Titanium Division plant in this region in 1935, the water table dropped at an alarming rate. The state looked in, found salt water intruding around the mouth of the Raritan River. So the three biggest industries in the area—DuPont, Hercules Powder and National Lead—formed a cooperative water-service organization.

Duhernal, as it is called, bought land along the South River, 8 miles below the affected area, dug a new well field and built pipelines to the companies' plants. A dam across South River formed a 178-acre reservoir—Duhernal Lake. It recharges the adjacent well field by seepage from its bottom. This recharge, about 5 mgd, stabilized the water table.

Duhernal manages all new wells, plus old ones at the three plant sites. Pumping from old plant-site wells is regulated to compensate for pumping by other area users whose withdrawal can't be controlled.

Canton's Answer. Recharging also worked for Canton, Ohio. There a shallow near-surface aquifer lies over a water tight (*impermeable*) clay layer which in turn covers a deep water-bearing layer. The upper stratum gets its normal recharge from the river. But capacity of the shallow aquifer wasn't sufficient and the deep reservoir didn't recharge fast enough.

The city put down two Ranney wells (p 109). These are right in the river, go down to the deep stratum. The deeper one draws from the lower level and feeds the city. The second puts out collecting "fingers" into the surface layer just below the river. What it takes is pumped down to lower level for recharge.

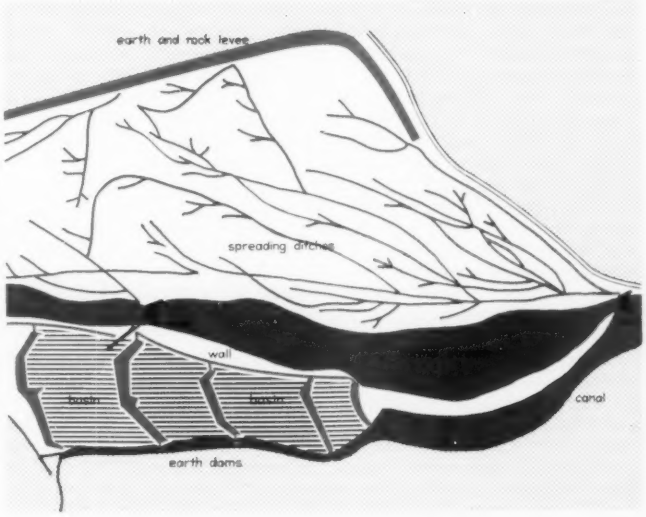
Spreading. A completely different recharge scheme has been tried in the West (diagram below). This employs various forms of "spreading" to increase water percolation from the surface to underground reservoirs. It has been used to trap flood water that might otherwise run off and to re-use treated sewage water.

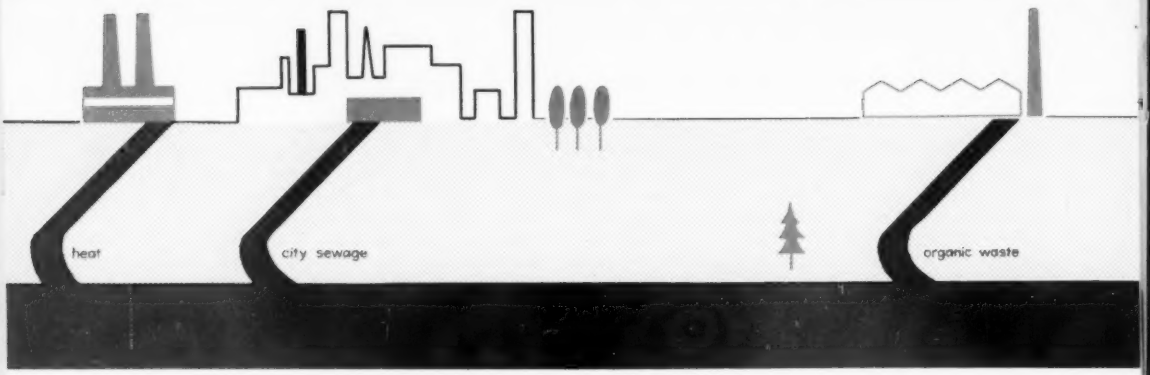
Recharging ground supply

Underground water sources recharge themselves by natural percolation of rainfall, flow of subterranean streams, or seepage from surface streams and irrigation channels. During flood conditions, amount of surface runoff is apt to be high and underground sources do not benefit proportionately. Where drawoff from wells is great, "spreading" may be practiced to increase the recharge of underground supplies.

The basic idea of spreading is to increase the area over which water flows and to retard it so it can percolate better. Two common methods are pictured: use of ditches or furrows (upper part of sketch) and use of dams or weirs to form basins (lower part). Canal at lower edge of diagram permits flushing silt from the surface.

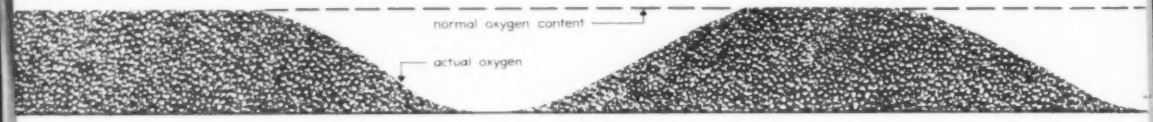
In many cases, spreading is done to salvage flood water that might otherwise run off, but it may also be used to recharge with sewage-plant effluent.





Heat discharged into stream raises its temperature. Evaporation will remove much of this heat during flow downstream. Heat pollution is only apt to be serious where a large amount is concentrated in relatively small flow

Sewage, or other organic waste, is converted by microbes in stream, which consume oxygen in the process. Oxygen is used faster than it is replaced by aeration, etc, and stream's oxygen content drops. Fish, vegetation, etc, dependent on it die. Worst "pollution" is at point of lowest oxygen content. Then, as oxygen demands are satisfied, and re-aeration gains, stream's oxygen content builds up. If not further polluted, it purifies itself in time.



...and on the tremendous task of restoring the...

All too often, the easiest and apparently cheapest way to get rid of waste products – individual or industrial – is to flush them into a flowing stream.

Using our streams for sewers makes them completely unsuitable for some purposes. For many others, the water can be used only after expensive treatment. The net effect is to reduce drastically our most readily available supplies – the surface waters. Ground water can also be polluted. While it is a less common problem, it's harder to cure and effects last longer.

Living Streams. To see how pollution strikes and what can be done about it, begin by realizing that each stream is the natural environment of many living organisms. The oxygen it carries supports a complex world of microbe, plant, insect and fish life. Effect of wastes on this delicately balanced world depends on their nature and concentration. We're concerned with what happens not only because many of these living things are useful – fish, for example – but because nature fights pollution and can be a useful ally if we work with her.

The struggle between nature and pollution shows clearest when wastes are organic – sewage, refuse from packers and canners, "white water" from pulp mills, etc. Micro-organisms in the stream feed on organic matter, using up oxygen in the process. As long as they don't consume oxygen faster than it can be replenished from the air, all is well and the stream will, in time, purify itself. Its oxygen content dips, but recovers.

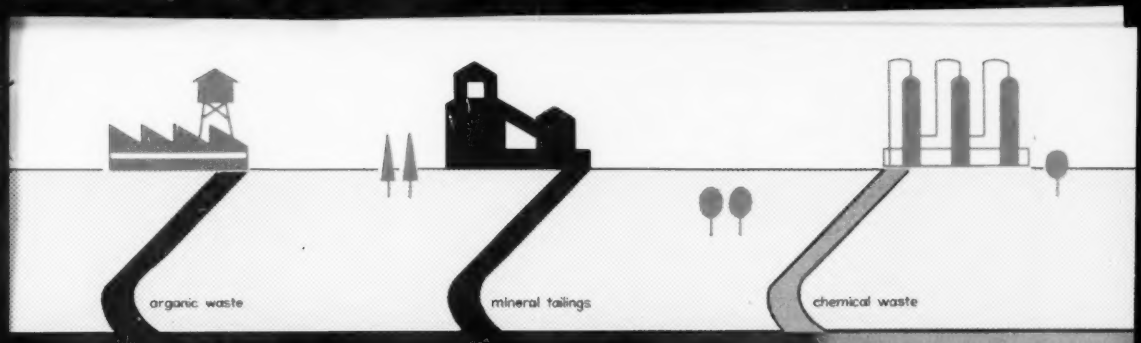
Sanitary engineers call the rate at which microbe population consumes oxygen the *biochemical oxygen demand* (BOD). When BOD goes too high because organic wastes are dumped into the stream, oxygen content drops, and the more sensitive organisms die. Below about 4 parts per million only the most rugged survive – all fish die, water becomes septic, noxious.

Pollutants Differ. Inorganic wastes act differently, although the end result is often the same. What might be called *chemical* wastes – acids, cyanides, etc. – are often directly toxic. They kill stream life and may make water unfit to drink. When soluble, they stay in the stream to its outlet.

Silt, mineral tailings and similar insoluble particles form *physical* pollution. They make water turbid and must be removed before it can be used for many purposes. As they settle, they may blanket the stream bed, smothering purifying organisms. Heat is another form of physical pollution, diminishing the usefulness of the water for cooling, and decreasing its oxygen content.

Complex Problem. Pollution can be controlled. The basic questions are How? and How much? There is no need to bar our people and industries from easy and economical means of waste disposal as long as such use does not unreasonably impair the other values of our streams. Sound control starts from this premise. The big problem is where to draw the line.

Streams differ in size, flow, biological characteristics and many other ways. Hence their ability to absorb



Organic Waste discharges may come close together in industrial centers. Natural forces of the stream may be able to make some recovery between pollution sources, but if load is too great, situation may become hopeless.

Mineral tailings and other insoluble materials slowly settle out of stream but the resulting bottom coating, if it's dense enough, may smother useful purifying micro-organisms and spawning and breeding places of stream life

Chemical wastes take a wide variety of forms. If they're soluble and not oxygen-consuming, they remain in solution as the stream flows along. How serious such pollution is depends on the nature of the chemical discharged

...natural purity of our streams, great and small

impurities differs. Kind of waste, and the amount of water coming into the stream with it (dilution), makes a difference, as does the amount of waste in relation to the stream flow.

Setting Standards. If only one sewage system or industrial plant were involved, setting pollution-control standards for a given stream wouldn't be too tough. But many pollution sources multiply the difficulties. How close are they? And does waste from one plant affect reaction between stream and others?

There are other angles: Control standards must take account of uses to be made of water and where it is drawn off in relation to pollution sources. And they must also make some effort to balance relative costs — costs of finding other disposal means or of treating wastes, compared with costs of treating water before use and of losing some or all of the stream's many kinds of usefulness.

It's clear that pollution control is no simple matter. Existing laws testify to this: none are perfect, some are completely inadequate. It's encouraging to note, however, many earnest efforts to work out better rules and standards. And the general tendency to stricter control shows a growing appreciation of the real costs of polluted streams and the urgent need for restoring them to reasonable purity.

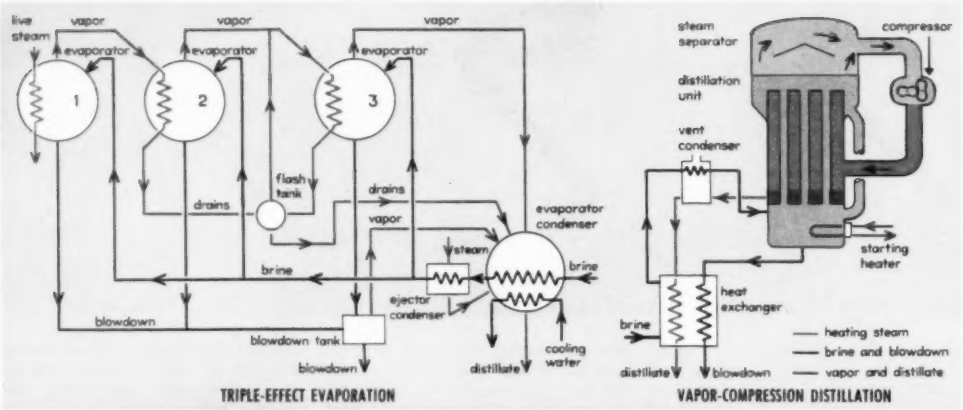
By its nature, pollution control is largely a local job. Basic power rests with the states. Most of them have pollution-abatement laws. But they vary widely in nature, administration, penalties and enforcement.

Interstate Compacts. The fact that larger streams cross or border several states calls for a wider basis of regulation. To an increasing extent, regional problems are being tackled cooperatively by interstate agencies, of which the Ohio River Valley Water Sanitation Commission is a prime example. The eight states joined in this compact have pooled their resources and police powers for preservation of water values in the Ohio Valley. This delegation of powers has been held proper by the U. S. Supreme Court.

From the beginning, the Commission has stressed persuasion rather than compulsion. It emphasizes education, research and cooperative participation by industry in the solution of pollution problems.

Federal Action. Under Public Law No. 845, the U. S. Public Health Service conducts studies on pollution. It has just completed a series of reports detailing conditions in major river basins. These indicate a total of 22,000 pollution sources; about half are municipalities. Under the law, the states have first chance to solve these problems. If they don't, the federal government can hold hearings, make recommendations. With state consent, Federal government can take legal action.

We are just beginning a rational attack on pollution. Most of the big job of salvaging and preserving our water resources remains to be done. Farsighted industrialists will recognize the need and play a cooperative part in the growing program.



TRIPLE-EFFECT EVAPORATION

VAPOR-COMPRESSION DISTILLATION

We dream of great new supplies...from the ocean...

Whenever large-scale water shortages threaten, interest swings to schemes for using totally new sources. Many are technically sound, but founder on the rock of cost. To be practical for general use, such schemes must produce water at a cost not too far from today's industrial average of 10 to 12¢ per 1000 gallons.

Desalted sea water has long been dreamed of as an ideal answer for coastal-area shortages. World War II developments in distillation and demineralization seemed to bring these dreams to reality.

Distillation Processes. In the familiar single-effect evaporator, raw water is boiled. The salt-free vapor coming off is condensed as distilled water. In multiple-effect designs, the condenser of the first stage becomes the boiler of the second, and so on (diagram above).

Increasing number of effects reduces fuel needs per gallon of pure water but increases plant cost. Triple-effect evaporators widely used in process work show fuel cost of about $1.00 per 1000 gallons.*

The newer and more-efficient vapor-compression distillation units use the heat-pump principle (diagram). Present best yields run between 175 and 200 lb of distilled water per lb of fuel (equivalent of power input). Fuel costs shape up in the order of 50-60¢ per 1000 gallons, total cost about $1.25.

These figures make fuel-distilled water more than 10 times as costly as softened Colorado River water delivered to Southern California. And as far as science can see ahead, large-scale plants won't reduce costs by more than half. Availability of waste heat from nuclear reactors might make a difference, but it's too early to assess comparative economies.

Solar distillation — by which nature gives us pure rain from ocean brine — has been proposed. An 1883 installation in Chile needed 9 sq ft of surface to yield one gallon per day. Latest MIT tests, in a tropical setting, got by with 4 sq ft, but in the U.S. about 6 sq ft would be needed. To match the 1000 million gallons per day (*mgd*) of the Colorado River Aqueduct would require 215 sq mi of solar pans.

Cost and complication make chances of using temperature difference between discharged condenser water and the ocean (Claude cycle) seem remote.

Ion Exchange. Synthetic anion and cation exchangers can now produce demineralized water purer than the best distilled in the laboratory. Such equipment finds wide use in process industries. But cost depends on salinity of water to be treated. High dissolved-solids content of sea water (32,000 to 36,000 parts per million total) requires heavy use of regenerating materials and wash water, puts costs out of sight for general applications.

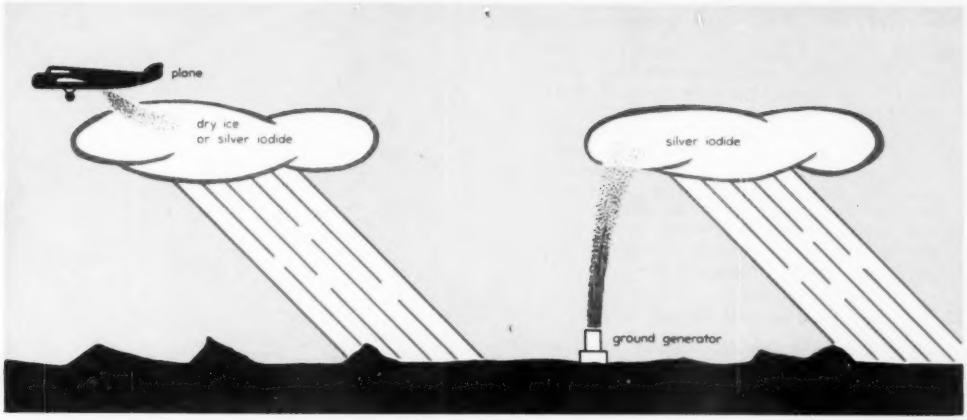
Purifying sea water by electrolysis is limited by low yield (less than one-third of raw-water input) and high power consumption.

Recent announcements describe use of a synthetic plastic membrane in an electrical field. Ion-selective membrane divides sea water into two streams: fresh water (two-thirds of input) and concentrated brine (one-third). Low costs are claimed for this process but few details have been disclosed.

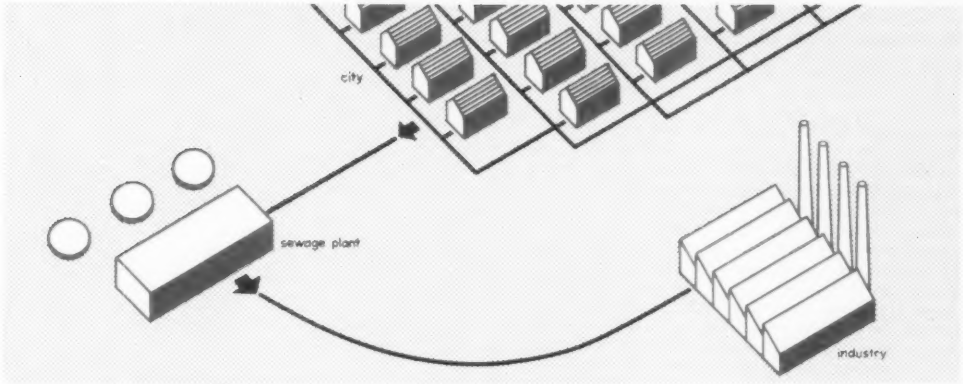
Cloud Seeding. Turning to a completely different source, modern "rainmakers" seek to increase rainfall by making clouds precipitate. The trick lies in introducing drop-forming particles (*condensation nuclei*) of exactly right size into clouds at the right temperature and ready to make rain.

Early trials seeded clouds by plane, particles were dry ice or silver iodide. This method is still followed, but in western states, where rainmaking is done on commercial contract, ground generators are generally used. These burn coke impregnated with silver iodide. A blower sends up combustion products in a stream of particles at the rate of 30 quadrillion per minute.

*This and other cost figures from "Desalting Sea Water," by W. W. Aultman, *Journal American Waterworks Assn*, August, 1950



...from the clouds... even from our own wastes



There's no longer doubt that properly handled seeding makes rain, but argument still rages as to whether it increases total rainfall or merely causes rain to fall in one place instead of another. Knottiest problems are legal – suits have been brought for damage from unwanted rain and for depriving nearby areas of rain they might have had. Whether such legal hurdles can be cleared remains to be seen.

Practical Answer. A very real source of untapped water lies, almost literally, in our backyards – sewage effluent. A major part of all water used in cities goes to flush sewage. Proper treatment can make this water usable for many purposes, even potable.

Psychological reasons make it unlikely that sewage water can be recovered for public use on a large scale – at least until water needs are vastly more desperate than they are now.

But such limitations needn't apply to many industrial uses. A growing number of plants treat their own wastes and recover water (often other valuable materials as well). And there are outstanding examples of industrials using municipal sewage water.

Bethlehem Steel Co takes an average of 46 mgd of treated sewage from Baltimore for its Sparrows Point plant. It pays $1000 per month for flows up to 25 mgd, $1500 for 25 to 37.5 and $2000 for 37.5 to 50.

Baltimore's Back River sewage plant has 20 mgd of activated-sludge capacity and 30 acres of low-rate trickling filters (239 mgd). Bethlehem takes up to 50 mgd of this plant's effluent and passes it, when necessary, through its own treatment facilities on the city-owned site. Water then goes through 7½ miles of 60-in. reinforced-concrete pipe to a reservoir for distribution in the Sparrows Point plant.

Within the next ten years, Bethlehem expects to take up to 155 mgd, the flow from a million people.

One river, one plan, many questions

One-sixth of all U.S. land area (529,000 sq mi) lies in the 13,000-mi-long and 700-mi-wide basin of the Missouri River. Larger than a big chunk of central Europe—France, Belgium, the Netherlands, Denmark, Germany, Switzerland, and Italy—this basin includes parts of 9 states and all of one, Nebraska (map, right). In it live some 8 million people, but the valley's resources, fully developed, could support many more.

There have been many plans for developing the valley and solving some of its problems. The river and its tributaries is a prime factor in all. Here are some highlights of the present Interagency plan:

Hydro power: who will distribute it?

After several upward revisions, expected total power capacity is put at slightly more than 3 million kw. More than half is in plants not yet built or started; about 20% hasn't been authorized by Congress. Immediate contributors are Army Engineers dams—Fort Peck and now-building Garrison, Oahe and Fort Randall.

Biggest bone of contention is the transmission system and who will do the energy-distribution job—U.S. government agencies or local utilities. A good part of the capacity isn't "firm", so another wide-open question is whether steam plants will be built.

Soil-conservation plan: will it get OK?

Dept of Agriculture's 30-year plan is a field-by-field creek-by-creek program of better land management. It hopes to enlist cooperation of farmers and ranchers on some 300 million valley acres. Not yet authorized by Congress, plan calls for: (1) seeding grass and legumes on 20 million acres (2) cover crops and "green manure" on 13 million now-barren cropland acres (3) stubble-mulching 34 million acres of grain land to reduce erosion (4) strip planting and contour plowing instead of old "square" farming on 63.5 million acres (5) almost 2 million mi of water-handling terraces (6) grazing limitations on 157.5 million acres of private range (7) new fire guards, fencing, trails to protect grazing land (8) tree planting on 5 million forest acres and reseeding of 400,000 acres of forest range (9) 2.5 million acres of shelterbelts and windbreaks (10) some 15,000 small upstream dams, 500 desilting basins, 5000 mi of minor floodways, 10,000 mi of channel improvements and 65,000 mi of diversion ditches.

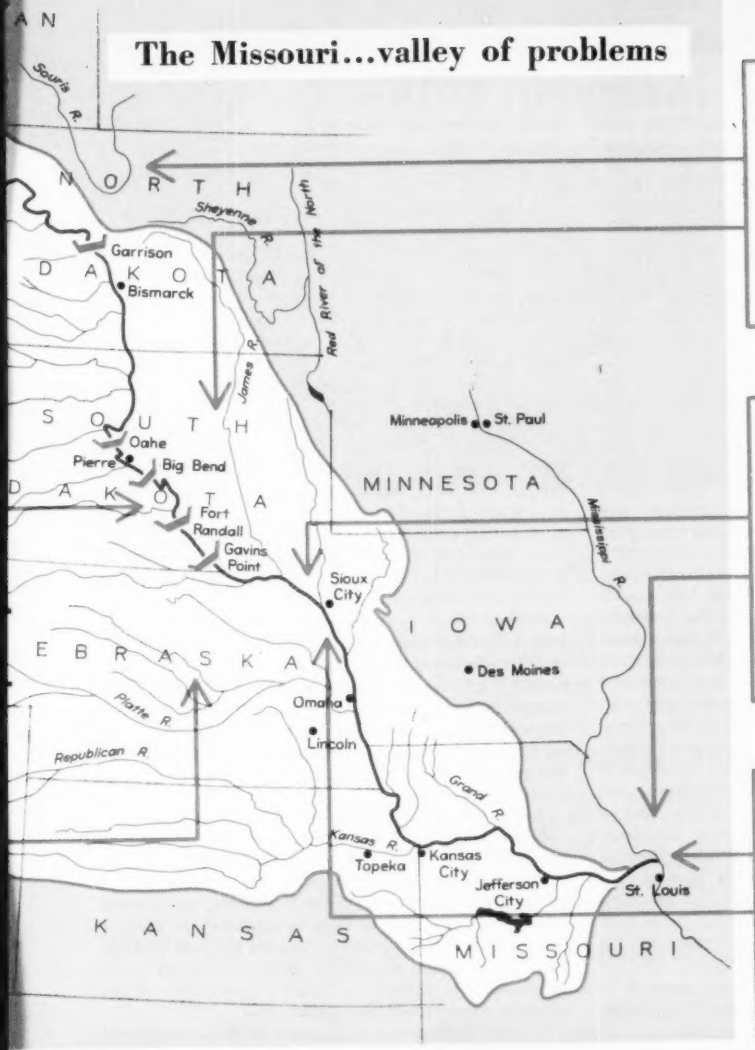
Improved land use is expected to reduce soil erosion, help control silting, lessen downstream floods.

Building integrated water-use programs for the...

"One river, one plan" is a slogan that makes a lot of sense. But it's tougher to put into effect than would seem at first glance. Part of the difficulty grows out of the complexity of water problems, and the natural conflicts of the interests involved. We've seen, in previous pages, examples of these problems and conflicts. But much of the difficulty lies in finding the best way to go about the job and resolving clashes between the numerous agencies charged with water responsibilities. To get some idea of what happens when we start to develop one plan for one river, let's take a quick look at an actual case.

Missouri Valley. To most of us, the big Missouri Valley problem is preventing the disastrous floods that have wreaked havoc, as recently as last spring. This *is* the prime problem but, as the map and captions above outline, there are many others. And to make things tougher, they are interrelated. Just for example, what is done about soil conservation in the uplands may affect downstream flood flows, and proposals for down-

The Missouri...valley of problems



Irrigation: more or less?

Original intention was to bring 5 million acres under irrigation and to provide supplementary water for 1.5 million more. Principal areas were northern North Dakota (Missouri-Souris Diversion); eastern South Dakota, to be served from Oahe; and northeastern Colorado, where water is being brought in from the Colorado River.

Mounting cost of bringing new irrigated land under cultivation makes status of program dubious, with reductions likely.

Flood control: how soon?

Biggest problem in lower eastern half of the Valley is stopping disastrous floods that have cost so much. Big upriver dams offer some help in river regulation but can't do anything about concentrated rains in downstream areas, such as caused 1951 Kansas City flood.

Plans call for dams on tributaries, special protection works for some cities, and levees at low spots along the 760 miles between Sioux City and the mouth. Rich bottom land covered by levees and in floodway between makes this solution expensive.

Navigation: too costly?

Present plans call for a 9-ft channel from junction of Missouri and Mississippi for the 760 miles to Sioux City. This work is nearly complete. The plan also offers the possibility of extending navigation as far as Williston, N. D., a total distance of 1656 miles. Means would have to be devised to pass the five dams on the way.

Keeping the river navigable is costly. Big question: Is heavy investment, plus maintenance, justified by value of shipping?

...nation's great river valleys still proves tough...

stream floodways may take rich bottom lands out of cultivation. Flood control, irrigation, power and navigation all tie together in the dam program. So it goes.

Enough Water? An over-riding problem, to which there is yet no firm answer, is the basic question "Is there enough water?" Present plans aim at making better use of stream flows, hence serve to increase the actual available supplies. But plans also call for increases in various uses. Past records of stream flow have been used to prove both adequacy and inadequacy of supply. It appears that only time will tell.

Some History. Two Federal agencies have a long history in water-development programs: (1) the Army Engineers, charged primarily with responsibility for navigation and flood control, and (2) the Bureau of Reclamation (Dept of the Interior), charged primarily with responsibility for irrigation. Power development has been an "incidental" feature of both programs. These agencies, and other Federal groups with water interests, have done much good work but it has often

...as interests and agencies come into conflict

suffered from lack of coordination. And there have been some charges of bureaucratic "empire building."

Pick-Sloan Plan. For the Missouri Valley, Lewis Pick, of Army Engineers, drew up a study emphasizing navigation and flood control—problems of the lower Valley. And William Sloan, Bureau of Reclamation, brought out a more elaborate report dealing with irrigation and related matters in the upper Valley. In what has been termed a "shotgun wedding," the two were merged in the Pick-Sloan plan, signed into law in 1944.

Meanwhile, it was becoming clear to Federal officials that some coordination of independent agencies was essential to successful river-basin planning. So Federal River Basin Interagency Committee was formed by agreement among Army Engineers, Dept of the Interior, Dept of Agriculture, and Federal Power Commission. Later Dept of Commerce and Federal Security Agency joined. From this sprung the Missouri Basin Interagency Committee (MBIAC).

Interagency Program. MBIAC fell heir to the Pick-Sloan plan, to which was added the proposed soil-conservation program of Agriculture, and a number of other elements. The states were brought into the picture more actively as planning and fiscal partners.

MBIAC today consists of six Federal members representing Agriculture, Commerce, FPC, Federal Security, Interior, and Army Engineers. Five state governors complete the roster. In this setup, interests of Army Engineers, Federal Power Commission, and Dept of Agriculture can be visualized readily. Interior's interest includes that of the Bureau of Reclamation, of course, plus that of Fish and Wildlife Service, U.S. Geological Survey, National Park Service, and these bureaus: Mines, Indian Affairs, Land Management. Dept of Commerce is concerned with economic and population surveys and the interests of the Weather Bureau, Coast and Geodetic Survey, and Inland Waterways Corp. Federal Security comes in largely from the stream-pollution angle (U.S. Public Health Service).

Toward MVA? Considering the often divergent interests of these "bedfellows," MBIAC has carried on with reasonable amity and cooperation. And yet there is recurrent demand for a Missouri Valley Authority—a single unified management of the Valley's resources planning and development instead of a "patchwork" confederation of independent agencies. Proponents of MVA say unification will be more economical, lead to better planning, eliminate bureaucratic conflicts. Opponents attack it as a "supergovernment" having complete control of all basin resources, and as one more step toward nationalizing electric power.

National Policy. Underlying much of the argument about MBIAC and MVA is a basic conflict of political philosophies—more government vs less, centralization of authority vs decentralization. And this same conflict fans the fire of controversy over the report of the President's Water Resources Policy Commission (WRPC) and the critique of that report issued by the Engineers Joint Council (EJC), representing the five principal national engineering societies.

WRPC Report. This document, must reading for all interested in water-use planning, outlines a water policy for the American people. Three principal goals are: (1) unified planning for entire river basins preceding any Federal participation (2) uniform national rules for all water-resource developments, under complete control of Congress (3) review of all projects by a 5-man Federal board appointed by the President with Senate consent.

Among many recommendations on which there is substantial agreement, one has drawn hot critical fire. Full development of the nation's undeveloped water-power resources, says the Commission, should be a major Federal responsibility. It adds that future licenses for non-Federal water-power projects should be issued only with joint consent of Federal agencies responsible for power in basin plans.

EJC Comments. In addition to commenting on the WRPC report, EJC issued "Principles of a Sound National Water Policy"—also required reading. Key to their approach lies in the statement, "Conservation and control of the waters of the U.S. are in the national interest but not necessarily a function of the Federal government. On the contrary, that which can be done by the individual should be done by him and that which requires collective action should be done at the lowest governmental level practicable . . ."

In sum, EJC agrees with many of the principles of the WRPC report, disagrees most with the means proposed for putting principles into action.

What Next? Most of us see the need for a water policy. And it makes engineering sense to develop unified and coordinated plans in place of patchwork programs of independent agencies. Our job is to find a way to achieve this while fully protecting the proper rights and interests of the states, local communities, private enterprise and individual citizens.

But, fortunately, it's easier to plan...

A water program for your plant

Responsibility for sound thinking on public questions of water policy rests particularly on us as engineers. Yet our first interest must be the solution of water problems in our own plants. With knowledge of water's behavior in nature as a foundation, it's our task to apply engineering methods and skills in devising water programs that meet the present and future demands of our managements—fully and economically. The pages that follow present the steps given in outline below:

Never make a major move without a thorough water survey

Water problems are tricky, highly technical, always important and sometimes crucially so. That's why you should make a detailed water survey before expanding an old plant or building a new one. And that's why, in general, your survey team should include an outside water consultant as well as the plant's own engineers. At best, hasty water decisions build future operating troubles. At worst, they can shut you down.

Study and compare all water sources available to you

A program is no better than its water source. Thus, time spent in checking present and future potentials of available supplies pays real and lasting dividends. In making comparisons, be sure you consider *all* possible sources. Remember that quality is often as important as quantity. Because different plant uses demand different characteristics, always consider the possibility of drawing from more than one source. Remember, too, that some treatment is required in most cases; allow for its cost when you compare water sources.

Engineer water use and waste disposal for top economy

Bringing in a good water supply is only part of the job. A complete program uses that supply with maximum economy. This means making effective use of automatic controls, evaporative-cooling equipment, multiple-use hookups and all the other engineering devices for water conservation. It also means applying practical psychology to the day-by-day task of avoiding wasteful practices.

Finally, remember that waste disposal is an ever more important phase of your program. Waste treatment is always good public relations, even if not required by law. And it often makes possible recovery of usable water, sometimes of valuable materials as well.

To steer clear of industrial water-supply pitfalls . . .

Water supply and distribution is a normal responsibility of the power engineer, along with such other services as electricity, steam, refrigeration, compressed air, etc. Yet because of its importance and technical complexities, water service is also an important field for the consulting specialist. That's why power engineers, with the active backing of progressive management, are increasingly using the services of water consultants to avoid the numerous pitfalls lying in the path of a sound water program.

If a new plant is under consideration, the consultant appraises possible water sources, balances desired characteristics against cost of various ways of getting and treating water. For existing plants, he studies the entire water system to see where service may be improved and operating dollars saved.

In plants where such skills are neglected water waste may be considerable, operations may be slowed and costs may run higher than necessary.

This doesn't mean the consultant works alone. In fact, he would be almost helpless without the constant cooperation of the power engineer in explaining equipment and operations and pointing out trouble spots. The two must work as a team.

Water Survey. The very first step is to make a systematic water survey. Results might be recorded on a form like that on the facing page, or on one designed for the plant's particular needs. Such a survey, equally useful for an existing or a projected plant, shows how much water is needed for each application—also the physical and chemical requirements of each.

A survey will help avoid one of the commonest pit-

1 Make sure that future supply will meet future needs

Perhaps the greatest single water pitfall is failure to foresee the effect of increasing demand or failing supply when you select a new plant site or expand at an old one. Both trends may act together to create a critical shortage in the near or distant future.

The only insurance against this double threat is an expert survey made before the site is confirmed. This survey will balance the lowest supply likely to be met against highest possible future plant need. Engineers making the survey must, of course, work closely with management in estimating future requirements.

2 Watch out for effects of changes in water quality

Pollution, or other changes in water quality, demands expert consideration. It's not merely a matter of making water "good to drink"—treating the small quantity needed for drinking may be a very minor fraction of total cost. Much more important, in general, will be the cost of making "bad" water suitable for process uses.

A detailed survey is the answer. It must cover not only treatment of today's water for today's needs but do the same for a future in which both the water and the needs may change.

3 Avoid the hidden costs of scale and corrosion

The popular conception of "good water" is crystal-clear water, free from all objectionable tastes, odors and germs—in short, "fit to drink." Yet from the industrial angle, such water may, in fact, be very bad. Scale and corrosion from such "good" water can slow down production, damage equipment, increase fuel bills. The only alternatives are to seek another water source or to spend money for proper treatment of the water.

4 High water temperatures may call for special steps

If you have many upstream industrial neighbors, river water may be too hot for economical cooling or process application. Here a survey is essential to any sound decision. It will show the extent of uses calling for cool water, the loss that will be caused by existing and expected supply temperatures, the investment in evaporative-cooling devices required to insure an ample cool supply, etc. The survey must allow for future changes in conditions.

. . . have a specialist survey your long-range needs

falls: wasting money to bring all water up to the strict requirements of some minor application — drinking water, for example. It will aid in planning for water recirculation and multiple use, indicate possibilities for segregating special needs of water supply or waste disposal to reduce treatment cost.

The worst thing that can happen, waterwise, is to build a new plant and then find, too late, that there won't be enough water to keep it going for years to come. This *has* happened, but it won't if you make a careful survey.

Such catastrophic errors are rare but many industrial plants suffer constantly from water waste, improper treatment, warm cooling water, excessive treatment cost and similar ills.

These are mere samples; the possible pitfalls are countless. Water treatment itself, once a fertile field for quacks, is now a specialty almost as scientific and complex as the practice of medicine. It just isn't possible to overstress the need for expert water management — by the teamwork of the water specialist and the power engineer.

Cooperative Action. Teamwork may well be extended to include neighboring plants, particularly if all draw from or discharge to the same source. In such circumstances, regional committees of plant men, reinforced by representatives of any local regulatory bodies, can do much to insure mutual consideration in the use of water and in the disposal of wastes. There are numerous examples of such practical cooperation — several interesting ones are cited on p 93 and p 95 of the preceding section of this report.

	gal per day, maximum	temperature, F	total hardness, ppm	suspended solids, ppm	dissolved solids, ppm	pH	organic matter	micro-organisms	color	turbidity	silica	iron and manganese	fluorides	carbon dioxide	hydrogen sulfide	dissolved O_2	chlorine	radioactive wastes	oil
drinking water																			
other sanitary																			
boiler makeup																			
air conditioning																			
refrigeration																			
compressed air																			
diesel cooling																			
steam condensing																			
fire protection																			
process A																			
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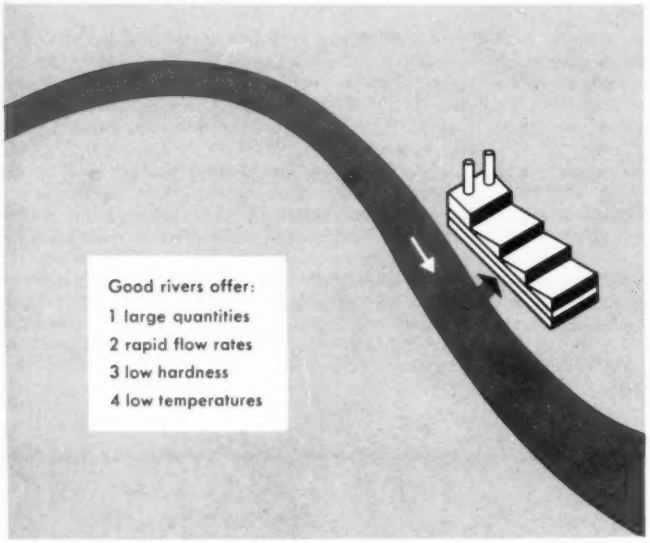
A nearby river may be your best source of water . . .



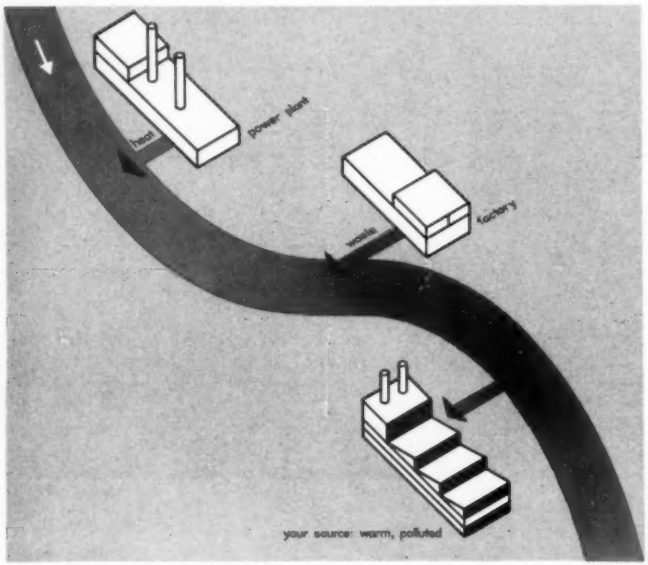
A good spot on a clean river generally means an ample supply of soft, cool water. And, if flow is rapid, plant wastes will disperse.

Pumping equipment for river water is usually easy to set up and maintain. (For factors in pumphouse design, see POWER, Jan 1949, pp 68-72.) Clear river water used for cooling in closed heat exchangers seldom needs treatment. But water carrying dissolved solids and organic materials may need pretreatment for most plant uses.

A river may well be your best source, but never fail to check water quantity, quality and temperature, plus local regulations on river use, before building a new plant. Allow for future changes.

Given a choice between river water, well water and water from a city supply, an engineering analysis (POWER, July 1947, pp 114-116) will help you decide.

. . . watch for pollution from upstream neighbors . . .

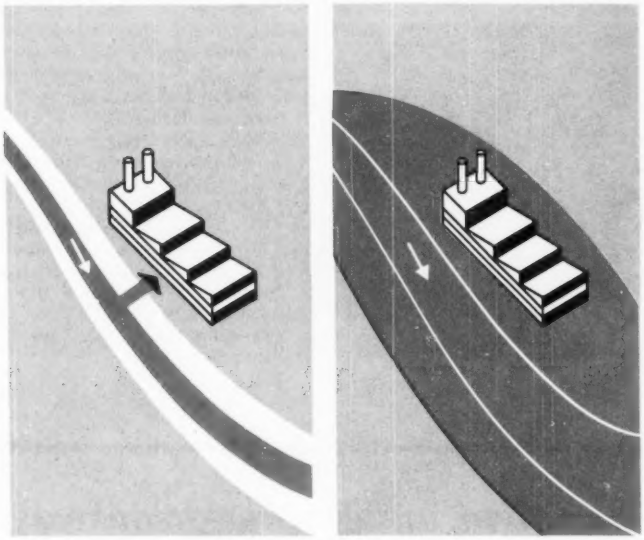


Discharge from upstream plants can pollute your intake or make the river too warm for economical use. If the effluents of upstream plants are within legal limits you have but three choices: use the water "as is," treat it, or build your plant elsewhere.

Temperature can be as much a nuisance as pollution if your plant requires much cooling for process or power generation. So stay as far away from other plants as possible, especially on small rivers. If river temperature runs high you may do better with cooling ponds, towers or evaporative condensers (POWER, April 1950 pp 112-113 and May, pp 102-106).

Screens (stationary or traveling) at river intake keep logs, fish, leaves and other debris out of pumps. Because solid debris tends to move with the current, try to locate suction intake and screen on the inside bank of a bend in the stream.

. . . but beware of possible drought, flood troubles . . .

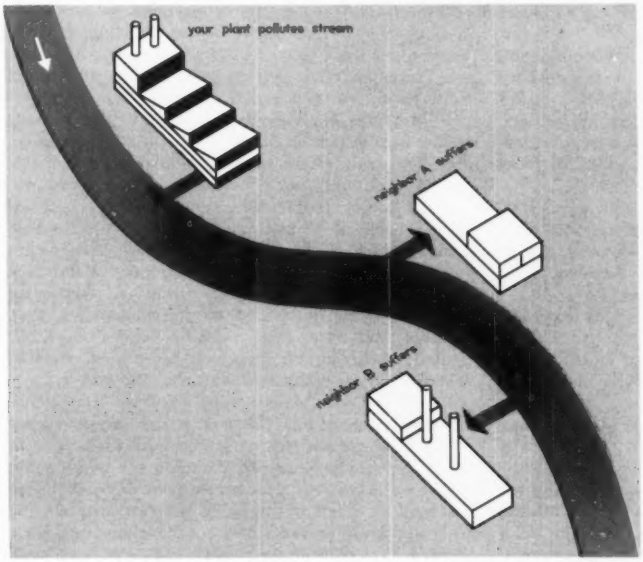


Droughts may cut river flow to a trickle, or stop it completely. Floods may damage your electrical equipment or goods in process—may even put your whole plant out of action. So before "marrying" your new plant to a river, study its history—above all, its long-time history of high water and low. Use such sources as records of the U.S. Geological Survey.

Long-time records may reveal risk of an occasional flood far beyond normal spring freshets, or a minimum flow below plant needs. To be safe, minimum flow should be several times process demand. If the river cannot insure this minimum, a standby supply must be arranged—one that will not itself be "dried up" by drought. Protect flood-exposed plants by design.

Remember, also, that turbidity and hardness tend to change with big differences in stream flow.

. . . and complaints of the plant owners downstream

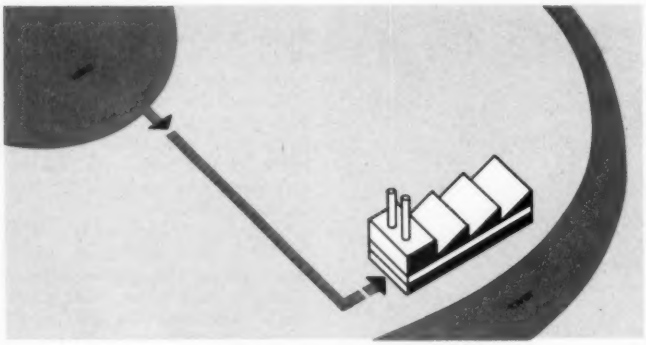


Operating a plant on a river is like living in an apartment house—other people must be considered. Effects of your plant's discharge may trouble other users as far as a hundred miles downstream, and pollution of river water can sometimes affect wells over a large area.

In many areas, local or regional regulations, supported by state laws with teeth, lay down allowable limits for the waste water you discharge into a river. And good public relations may require your plant to purify its discharge to even closer limits than the law lays down, or treat wastes even if there are no regulations.

Before you select a river location for your plant consider not only the quality of water you will draw from the stream but cost of treating wastes you discharge into it. Remember, also, that waste treatment may pay for itself in water and other materials recovered.

Sometimes your best water source may be a lake...



It may actually prove cheaper to pump water from a distant lake than to use a nearby river that is badly polluted or has a history of droughts and floods.

Possible lake-water advantages: It has time to settle and composition is fairly constant. Seasonal turbidity and level changes are predictable and pollution is generally easy to control. Lake water usually is softer than well water but may contain organic matter, perhaps making it unfit to drink. (For data on lake-water cooling, see POWER, Sept 1951, pp 86-89.)

Many plants develop good underground sources...

Well water runs fairly constant in composition and temperature, is often hard. If properly protected by cement casing, deep wells are usually secure from contamination by industrial wastes or sewage. Their water is clearer, has fewer organic colors, tastes and odors than usual surface supplies.

Well Types. A *shallow well* is fed by water lying above the uppermost water-tight (*impervious*) layer. A *deep well* penetrates one or more impervious layers to draw water from an underground supply. The terms *shallow* and *deep* are sometimes used to denote depth.

An *artesian well* is one in which water is forced up the tube by underground pressure (p 85). If water flows from the well at ground level, it is a *flowing well.*

The *Ranney well* gets its water from a large underground area through horizontal pipes radiating from the central tube.

Construction. Good construction is important. Method used depends on type of well and nature of material to be penetrated. A very shallow well, in easy soil, may be dug by hand. Some shallow wells are driven by means of a wellpoint.

Deep wells may be drilled, a core drill being used to penetrate rock. Softer material is cut with a water jet, or a pipe is forced through it, or a drilling rig lifts and drops a heavy bit. In pervious soil a casing of wrought-iron pipe is driven into the hole and several inches into the impervious layer to keep subsoil water out of the well.

For moderate depths in sand or gravel, the horizontal-collector (Ranney) well is growing popular for industrial and municipal water supply. Perforated pipes are driven spoke-wise from the bottom of a large-diameter central shaft. Each pipe is preceded by a digging head, which selectively removes silt and fine material from the path of the pipe and the surrounding soil. This leaves the pipe housed in a gravel bed 4 to 6 ft in diameter, perhaps 200 or 300 ft long.

A common type of horizontal-collector well has a central shaft 16 ft in diameter, fed by ten 8-in. ducts. Flow from each is regulated by a gate valve controlled from the top of the well.

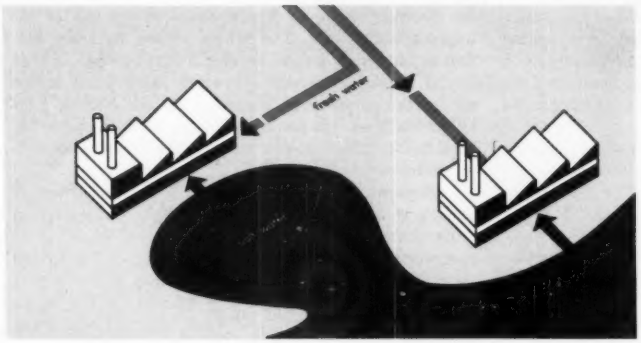
Collector wells often prove particularly successful in saturated ground near the shore of a lake or river. Intervening soil filters out industrial wastes and sewage. Large effective area of well makes a high yield available for peak demands or emergencies.

Well Yield. The yield from a shallow well depends on the rate of percolation, which may vary considerably with rainfall or other factors. Large-diameter shallow wells yielding a million gallons per day are not uncommon. Some Ranney wells have a normal yield as high as 30 mgd. A deep well is usually free from seasonal variations but eventual depletion may be difficult to foresee and guard against. Yield of a deep well can sometimes be increased by lowering an explosive to the bottom, where it is detonated. This requires skill, is of little value in sand formations. Cleaning with suitable chemicals has proved effective in increasing or restoring yield of wells.

Pros and Cons. Main advantages of well supply are flexibility of location, clarity of water and constancy of composition and temperature. Lack of oxygen in water may foster anaerobic bacteria (slime growth).

In some situations, first cost will be fairly high but this may be offset by savings in pretreatment. On the other hand, unforeseen additional developments, such as need to drill very deep, may add greatly to cost.

...perhaps a tidal harbor, or even the ocean's shore

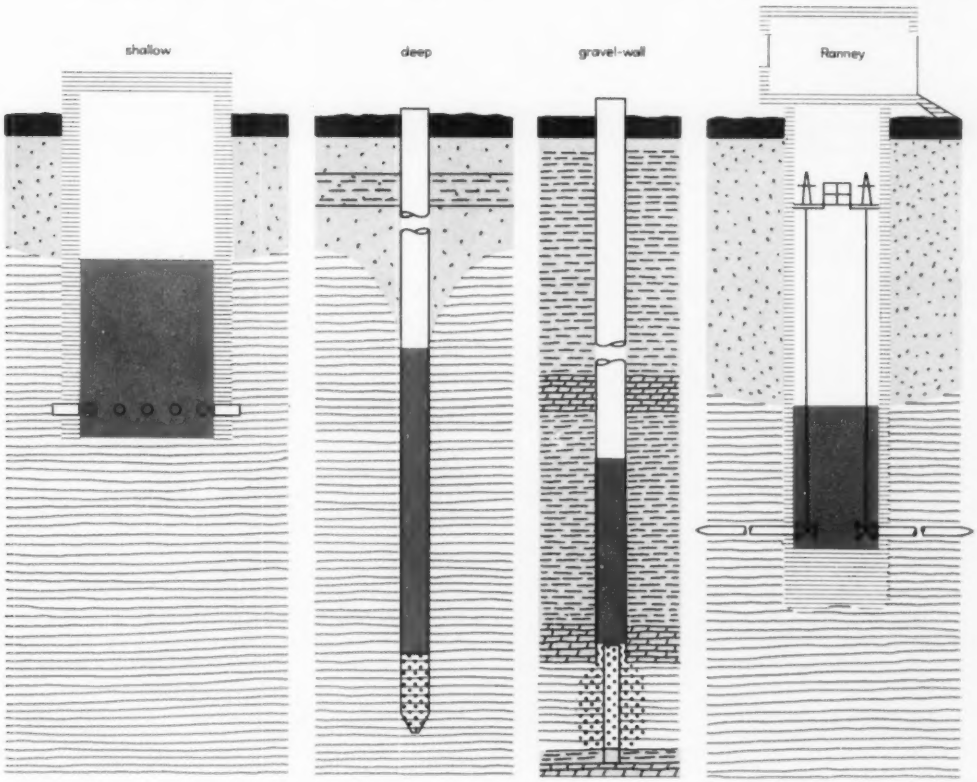


Where cooling is the prime need, consider sea water. It won't harm heat exchangers of suitable materials and design. Sea water varies little in temperature and is inexhaustible in supply.

Harbor locations offer transportation and other facilities, are protected. Sites on the open coast require special precautions against surf and storm but avoid oil slick and other harbor debris.

Minor fresh-water needs may usually be met from city supply, wells, or surface sources. Desalting sea water is uneconomical (p 98).

...employing these four fundamental types of wells



Don't waste your time on willow-stick guesswork...

If the water is there, hit-or-miss well sinking may produce enough of it for immediate needs. But the guesswork and unsound practices of the past have wasted millions of construction dollars and ruined many good underground water supplies. Now, more than ever, it's important to handle well location and construction as engineering projects.

Here are typical steps: (1) Select site after studying all available geological and hydrological data. (2) Make one or more test bores. (3) Design the well in detail. (4) Assemble the gear and crew and drill the well. (5) Test the finished well.

Gravel Packing. Water flowing from sand formations carries fine particles in suspension. When flow is excessive, particles may tend to plug the screen and reduce well capacity. To prevent this, end of well may be enlarged and packed with graded gravel around the intake screen.

Under-reamed gravel-packed wells are the latest examples of this type. During construction, the section of the well extending through the water-bearing formation is under-reamed to large diameter. The resulting annular space is filled with gravel. Selection and placement requires expert supervision to produce a blanket that will hold the native sands in position, yet insure full ease of flow to the screen.

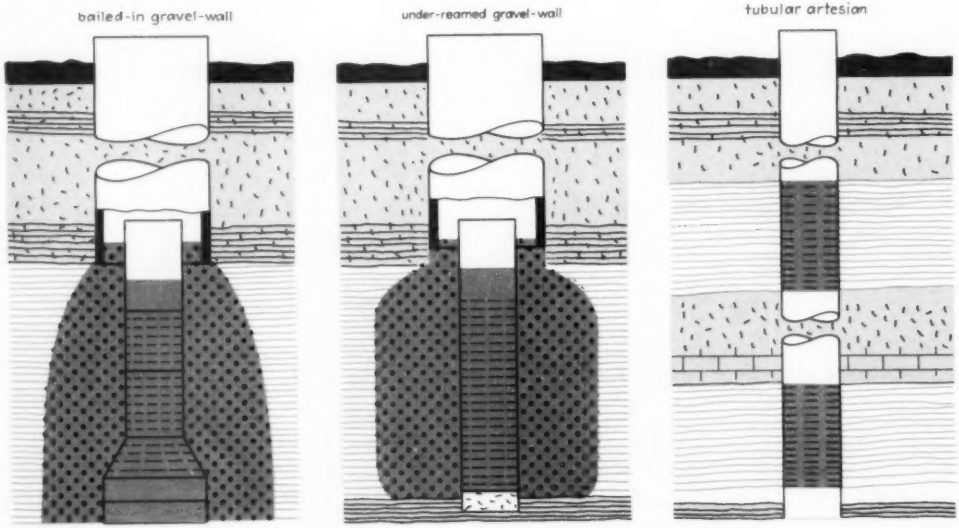
Modern gravel-wall wells are not cheap, but they do an excellent job. Pipe or casing for under-reamed wells need be only large enough to take the pump. Under-reamed sections may be 30 or 36 in. in diameter for an 8-, 10-, or 12-in. screen. Drawdown is moderate, specific producing capacity is high.

In the "bailed-in" type of gravel-wall construction, an outer casing, of greater diameter than is planned for the riser tube, is driven down to the top of the water-bearing layer. The intake screen, its lower section expanded to a cone bearing a cutting edge, is then forced through the water-bearing layer until sealed off by the impervious material. As the cutting edge advances, gravel is packed into the annular space behind it. Net effect, of course, is about the same as with an under-reamed well.

Cemented Wells. Today, most health departments require cemented well casings in state or municipal wells. A neat cement slurry is introduced under pressure at the bottom of the metal casing and is forced up around the casing until it overflows at the top of the well. The main purpose is to seal off the well's supply from the subsoil and other water. The coating also protects metal casing from acid or other corrosive ground water, removes cave-in danger.

Well Spacing. When a group of wells is to be constructed for a plant, its axis should, if possible, lie across the general direction of flow of the underground water. The optimum distance between neighboring wells may lie between 400 and 1000 ft, but in some situations may be as much as 6000 ft. Effective spacing of deep wells, which are expensive to construct, may require much study, itself expensive. Where shallow wells may be dug cheaply, the best method may be to sink wells at various intervals until satisfactory results are obtained.

For additional data on well construction, see POWER, Aug 1951, pp 74-76; on well pumps and their maintenance, pp 120-123; on testing wells and well pumps in the field, p 150 (POWER Data Sheet No. 230).



. . . but pin your faith on thorough well-engineering

Water, like gold, is where you find it. The water for man's use often lies deep in the earth and must be pumped to the surface. The pump used may be of the *plunger, turbine,* or *jet* type.

Plunger Pumps. These are a refinement of the old wood-cased hand pump that was used in country-home and small-town wells.

Drawing c shows the business end of a modern plunger pump. The casing, now of heavy drawn-brass tubing, usually extends below the water level and up to the top of the well. A modern motor-driven pump will deliver up to 800 gallons per minute at 800-ft head.

Turbine Pumps. These are also known as *deep-well, bore-hole* or *turbine-well* pumps. Sketch *a* shows such a pump. Main components are: drive head, discharge column, pump bowl and suction pipe.

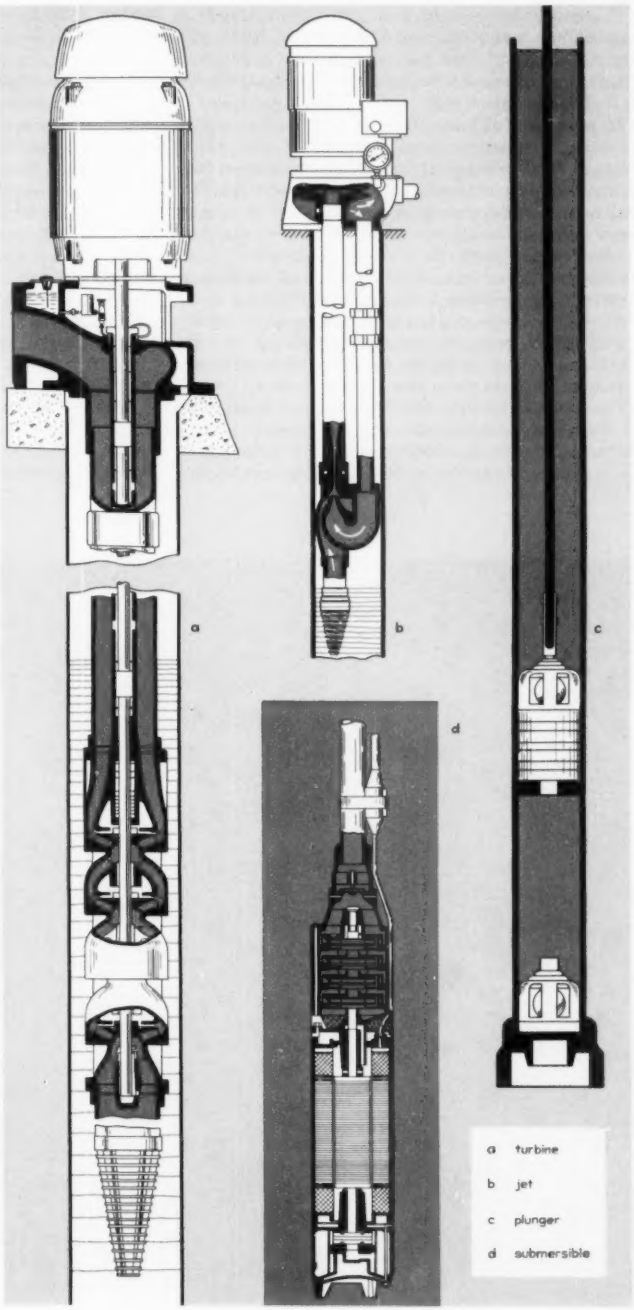
Submersible-motor type of turbine pump is sketched at *d*. Motor works under water, in a mercury-sealed housing that keeps water away from electrical parts and rotor bearings. Pump and motor form a compact unit, supported by the discharge pipe. An armored submarine cable and an oil pipe run from unit to top of well.

Turbine-pump capacities run from 25 to above 25,000 gpm, with discharge heads to about 1000 ft. Diameter ranges from 4 to about 42 in., depending on capacity.

Jet Pumps. A typical jet pump appears at *b*. Design is simple and all moving parts are aboveground. Water under pressure from the pump impeller discharges through a "drive pipe" to the nozzle. High-velocity stream from the nozzle pulls water in from the well and pushes it up the pipe to the outlet.

Deep-well jets work best at capacities up to 50 gpm, where the lift exceeds 25 ft. Lifts up to 120 ft are common, and some jets perform well up to 150 ft. Jets have been used for lifts as high as 400 ft, but with considerable loss of efficiency.

Jet-pump discharge usually runs to a storage tank from which services are fed. A control valve throttles pump's discharge, keeps pressure on jet.



Always think of treatment incoming water might...

No matter where you find your water, there's a good chance you must treat it before use. Even with city water, usually the purest available to industrial plants, treatment may be needed before it can be fed to a high-pressure boiler.

Impurities. For industrial purposes the undesirable qualities of water may be conveniently grouped as follows: dissolved mineral matter, dissolved gases, turbidity and sediment, color and organic matter, tastes and odors, micro-organisms. The amount of any of these that can be tolerated will depend on the particular use for which the water is intended.

Most industries using large amounts of water have a private supply because it is cheaper to pump water than to buy it from a city plant. Yet many well-engineered plants buy city water for drinking and fire protection while drawing the far greater process-water requirements from river, lake, well or harbor.

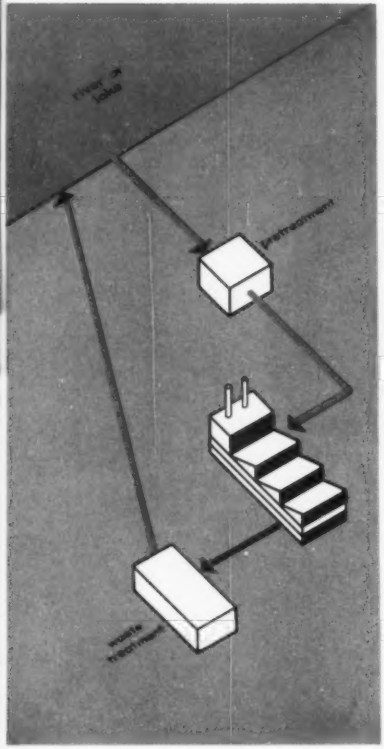
Treatment. Deciding what treatment to use is a job for the water consultant. He must consider the plant's various requirements (both present and future) and composition of available water. The treatment he prescribes may involve several of these basic processes:

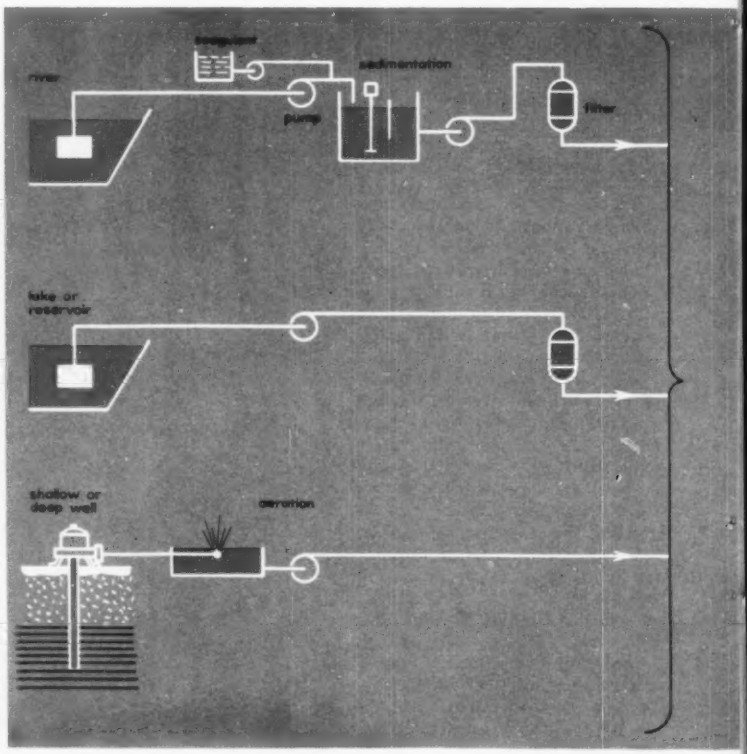
Aeration. Scouring action of air in motion can remove many undesirable gaseous and volatile impurities. These include hydrogen sulfide, carbon dioxide and volatile organic matter. Aeration may also oxidize iron and manganese compounds present, making it easier to remove them later.

One way to aerate is to allow air to bubble up through the water from small holes in submerged pipes, plates or strainers. Another is to expose water to the atmosphere, or moving air streams, in the form of thin sheets, small streams, drops or sprays.

Coagulation. Where suspended particles are too small for easy removal by filtration, adding alum or other coagulants will combine them into larger particles and speed subsequent settling and filtration. Ferric sulfate, chlorinated copperas, are other coagulants. Activated silica, and clay, may aid coagulation.

Filtration. Passing water through a filter bed of graded sand, or other material, removes most of the suspended matter and turbidity. Filtration is almost invariably preceded by coagulation, sometimes accom-





. . . need when you stack one source against another

panied by settling. Gravity filters operate on gravity head only, pressure filters can be inserted in the line.

Chlorine gas or chlorine compounds may be added to kill micro-organisms (algae, etc.), disinfect the water.

Softening. Hardness, in the form of scale-forming calcium and magnesium salts, is chemically precipitated by lime (calcium hydroxide) and soda ash (sodium carbonate). "Cold" process runs at normal water temperature; far more speedy "hot" process operates at around 212 F. Lime-soda softening is often used to prevent scale and sludge in boilers, reduce calcium carbonate deposits in heat exchangers.

Cooling-water systems are stabilized by adding 1 or 2 ppm of glassy phosphate. This kills off crystal nuclei, keeps calcium carbonate dissolved.

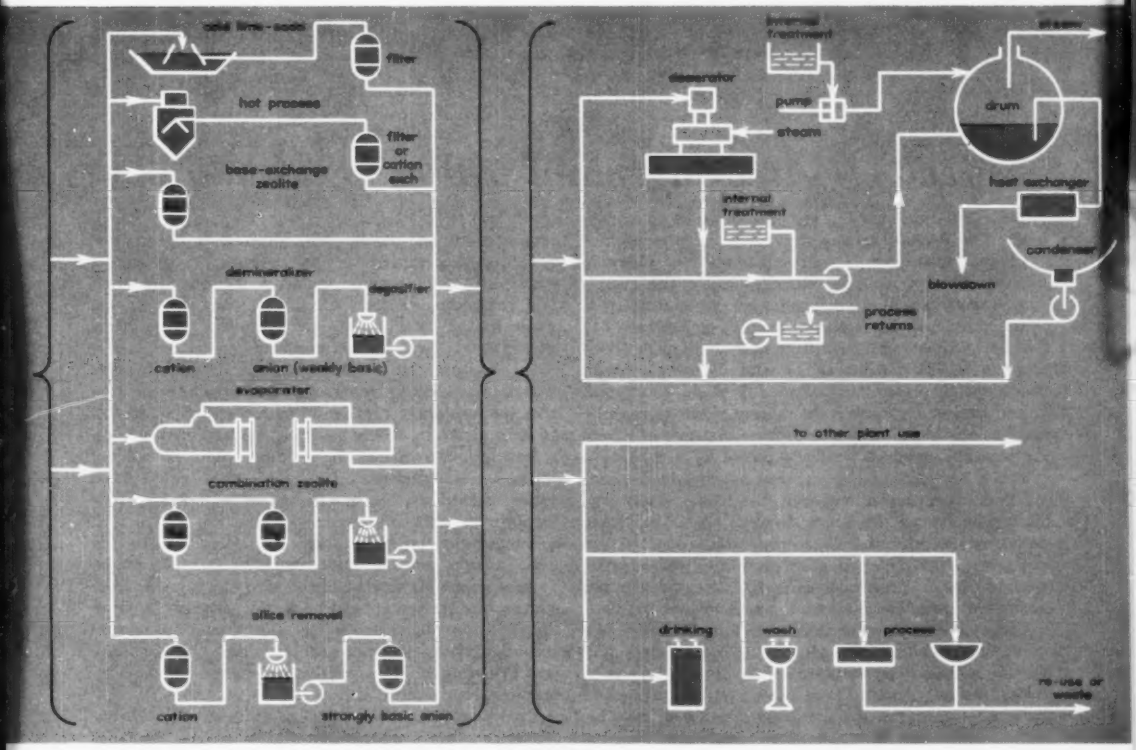
Ion Exchange. Unlike lime-soda treatment, ion exchange leaves no precipitate. All impurities are eliminated in soluble form. For example, a sand-like material, the so-called "sodium zeolite," will exchange sodium ions for those of calcium and magnesium. In that way the scale-forming carbonate and sulfate of calcium or magnesium become the completely soluble carbonate and sulfate of sodium. When exhausted, the zeolite bed is restored to its original activity by a wash of strong sodium chloride brine. Today, synthetic resins are widely used as ion exchangers.

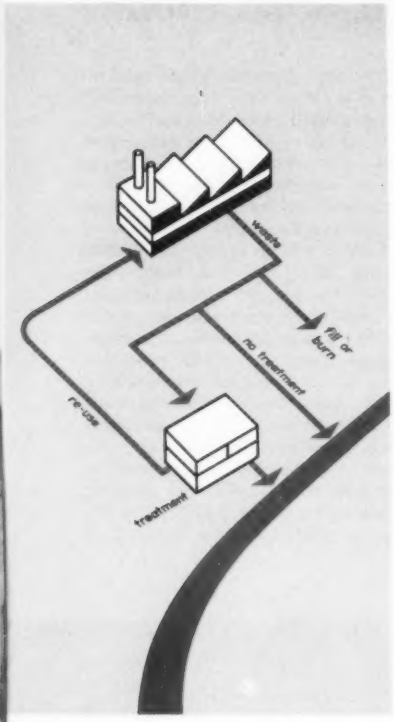
Demineralization. By combining ion-exchange units, extremely pure water may be produced. In a typical demineralizing unit, water flows through *cation* and *anion* exchangers and a degasifier.

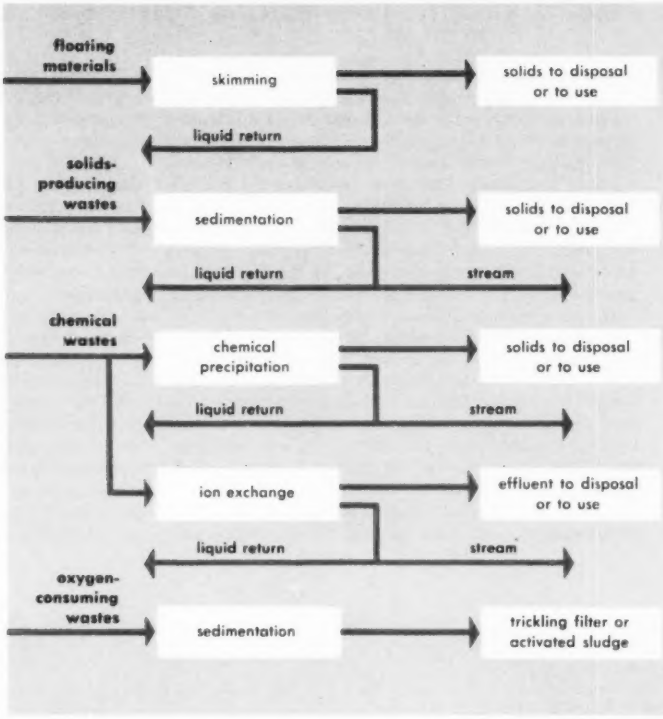
Distillation. Formerly the only way to produce water of high purity, distillation has been losing ground to demineralization because of its higher operating cost in many cases. Distillation frees water from nonvolatile impurities. Increasing the number of effects in an evaporator from one to three or four increases first cost and decreases heat consumption.

Silica removal. The cause of glassy turbine-blade deposits, silica, may be removed by ion exchange, using a strongly basic anion (sketch below).

Internal treatment. The sketch shows some of the special internal processes used in the treatment of boiler water. These and others are discussed in POWER's special section on water treatment (Dec. 1947).







Remember – treating plant wastes keeps you out . . .

Like treatment of raw water, waste treatment is a specialist's job. Call him in at the start of planning and have him work with you throughout the job.

Waste Disposal. As diagrammed above, waste-disposal problems have three possible solutions: (1) Discharge waste to stream or other point without treatment. (2) Discharge to stream after enough treatment to prevent pollution. (3) Treat so effluent or solids may be re-used. In rare cases, there may be another answer: change the process so waste products are harmless or may be easily recovered.

Three key men are involved in any waste-disposal problem: the plant's engineer, the local regulatory-body official and the waste-disposal specialist. Joint decisions should be satisfactory to all.

Treatment. Center diagram simplifies waste types, methods used. Treatment is a specific problem for each plant; what works for others might not for you.

Three general treatment methods adaptable to industrial wastes are: (1) physical (2) biological (3) chemical. They may be used singly or jointly.

Physical Methods. These use screening and gravity separation in various combinations. Trash may be ground up in flow through a comminutor, or may be screened out, ground up, and returned to liquid flow.

Grit chambers reduce flow velocity so dirt, sand, grit and bits of organic matter settle out. Mechanical collectors remove solids; washing returns organic matter to liquid stream. Resulting organic-free grit makes a good fill material.

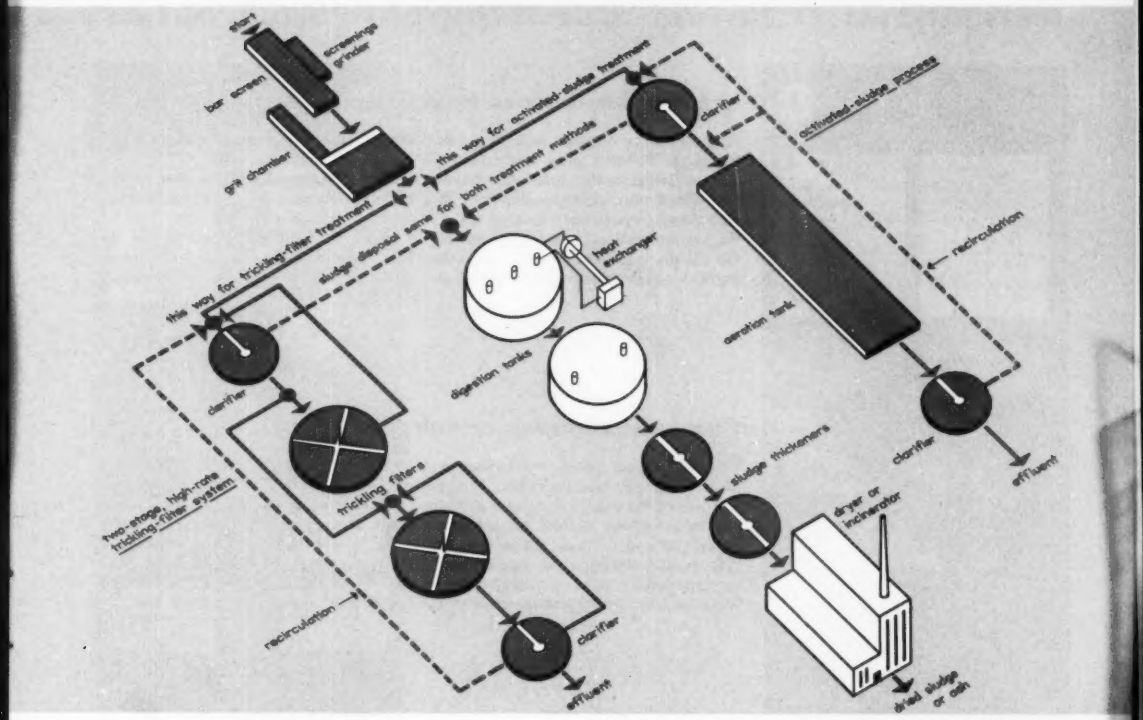
In flotation, air is blown through liquid to give buoyancy to lighter materials. They float to the surface for skimming. More modern method uses vacuum to help air bring solids to liquid surface for removal.

For gravity separation, sedimentation or settling tanks have dimensions to reduce flow velocity so solids carried by the liquid deposit out. Sludge-collection equipment simplifies cleaning.

Evaporation, which is also a physical method, is used in some cases to concentrate or separate solids.

Biological Methods. These secondary treatments come after screening, grit removal, primary settling and flotation. In them, bacterial action reduces oxygen-consuming elements and stabilizes organic matter. Trickling filters or activated sludge are used to produce the bacterial action.

Trickling filter has a bed of broken stone, large gravel or other irregular material in a tank. Bacteria



. . . of legal trouble, and may actually pay dividends

on bed surfaces feed on waste's organic matter. Biological-oxygen demand (BOD) of liquid falls so effluent is suitable for discharge to a stream (p 96).

High-rate trickling filter equipment passes waste through filter several times before discharge. Revolving distributors spread waste evenly over filter. These plants usually have clarifiers ahead of and after filter, as in diagram above. In all treatment processes, function of clarifier is to remove settled solids. Digesters remove harmful organic matter from sludge.

In another biological method, a mixture of raw waste and activated sludge is agitated and aerated. Blower or compressor supplies aeration. In smaller plants, mechanical agitators use only small amounts of compressed air or atmospheric air, cutting cost.

Chemical Methods. These precipitate finely divided solids, remove "color", neutralize acid or alkaline materials, or crack grease and oil emulsions.

Chemical precipitation is faster than sedimentation. But precipitate may have large volume and need special dewatering or drying. Be sure treated waste discharged to a public sewer system contains no chemicals that might inhibit later biological treatment.

Use common chemicals for treatment, if possible. They reduce running costs, are easier to get. Automatic control of plant operation also saves.

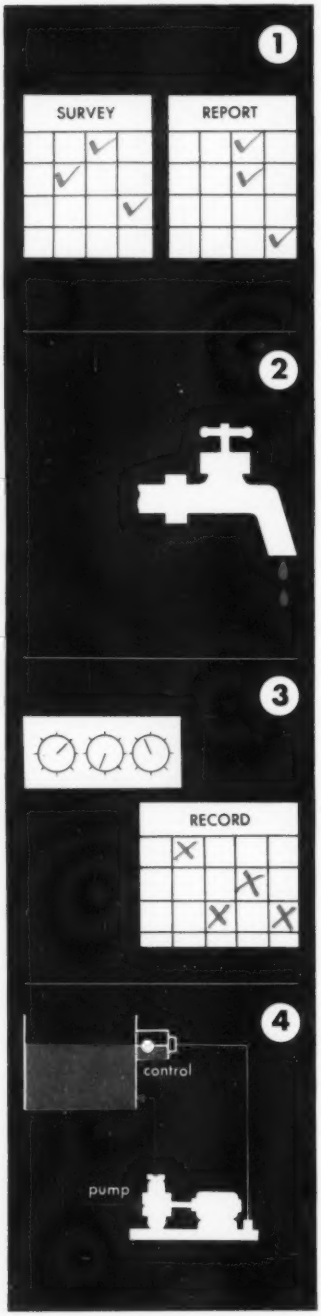
Other Processes. These include sludge digestion, thickening, filtration, drying and incineration. If waste contains valuable dissolved solids, ion exchange is often the best way to remove them.

Typical Plant. Diagram above shows components of a high-rate trickling filter system and an activated-sludge system. In a typical industrial or municipal treatment setup, one or the other would be used. As diagram shows, primary treatment and sludge disposal are the same for both. Sludge is incinerated or may be used for fertilizer manufacture.

Re-Use. Many wastes contain byproducts of commercial value. These can often be recovered, but be sure to secure a specialist's advice on treatment and utilization. Don't count on byproduct recovery to pay entire cost of treatment-plant operation. Primary reason for treatment is pollution abatement. And don't forget, re-usable water may be a valuable dividend.

Depending on plant's product and treatment used, byproduct may be solid or liquid. If special equipment is needed for recovery, initial and operating costs must be balanced against savings of recovery.

Here are ways to save water in your plant, old or . . .



Organize for better water management

If plant water demand runs ahead of supply, or if water costs are high, one cure is better water management. If possible, assign an engineer to the job and give him staff help if he needs it. Or, set up a water committee — one of the plant's engineers plus key men in big water-using departments. It is often helpful to get the fresh views of an outside consultant.

First step should be a complete water survey, followed by a report listing specific steps to cut water use.

Remember, human relations are a big factor in water economy. Put men on the job who can win cooperation.

Plug leaks and stop the everyday wastes

This part of the job is mainly human engineering — getting people to do the things they should do anyway.

Don't overlook things like turning off faucets and showers, but be sure to give heavy attention to service and process departments. Either because they don't know any better, or they're careless, machine operators often use more water than the job needs.

Make sure your maintenance program insures regular inspection and repair of valves, faucets and other water-system equipment. Small leaks add up. If insulation holds proper water temperature, you often can use less.

Use meters and records to encourage saving

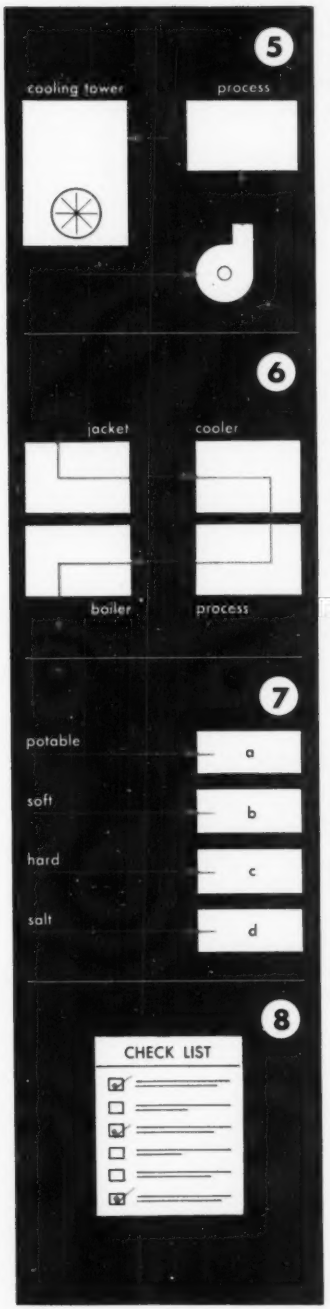
It's been proved over and over in industry that people will waste what they get "free." To succeed fully, a water-saving program must harness the profit motive to persuasion. Departmental metering is the most effective way to do it. Meter the water delivered to each major department, and find some means of estimating take of minor users. Follow through with a monthly report or, better still, an actual direct charge against the using departments. This gives a real incentive to reduce consumption. Then when you offer engineering help in water saving, your suggestions will be welcomed.

Install automatic controls as "watchdogs"

After everyday water wastes have been eliminated, by an organized plant drive, there remain many water-saving methods that are strictly in the engineers' province. One of these is the use of automatic control to make sure water flows only where and when needed, without human errors.

Typical examples are: float and pressure controls for tank makeup, thermostatic valves in cooling-water circuits, start-and-stop controls so water flows only when machines run. Orifices or other limiting devices may be put in lines to water-using equipment. Then operator cannot run water too fast.

. . . new, by smart design, operation and maintenance



Look into advantages of evaporative cooling

In many plants, the greatest chance to save is by re-using water now discharged to waste from engine or compressor jackets, condensers, etc. Led back to a cooling tower, spray pond or evaporative condenser, hot discharge water may be cooled by evaporation.

Evaporative cooling is highly efficient: water loss is usually less than 5%. Design of evaporative equipment is a complex engineering specialty, so seek expert advice that will fit the installation to the plant and local climatic conditions.

In some areas, city water may not be used for cooling unless recirculated.

Investigate possibilities of multiple use

In almost any manufacturing plant, the inquiring expert eye can spot opportunities for multiple use of water. Water discharged from one use may be perfectly suitable for another. For example, almost any water may be used for flushing toilets. Even cooling water can often be given a multiple use, going first to processes requiring a low temperature and then to others able to get along at higher temperature levels. Water heated in this step-by-step fashion may then be used in some process needing warm water, perhaps with some supplementary heating. Possibilities are endless; watch out for them.

And the equally good ones of multiple supply

Water good for drinking may not be for boilers. And sea water, good for neither, is usually satisfactory for condensing and cooling. Thus many a plant that seems short of water merely suffers from an illusion. The trouble arises from trying to make entire water supply good enough for de luxe uses.

Duplication of piping and pumps may be a small price for a system that will hoard the scarcer and more refined forms of water and supply each process with the cheapest it can use.

Same idea applies to wastes—it often pays to segregate for separate disposal those wastes needing costly treatment.

Use a check list to avoid missing any bets

The suggestions here are in the nature of a "shopping list" — there are many possible ways to cut water use. Make a check list of your own and don't rest until you've followed all the way through on it.

Here are some random thoughts for such a list: See if processes can use less water or water at a different temperature. Pick up and re-use returns or drains from bearings, drinking fountains, glands, etc. Recycle process water (as now done with white water in some paper mills). Rest your wells in winter months when surface water runs cold enough for process cooling.

So we see that the water problem, which starts with hydrology and ends with politics, places the engineer at the very center. There he must hold fast if America is to avoid the costly water errors of the past.

Whether it be flood control, hydro power, or managing a complex industrial water-service system — the manipulation of water for man's good is an engineering job.

We hope this fact will always be kept in mind by all non-engineers who have a voice in water policy — by business and industrial executives, by political and community leaders, and by the public in whose interests they must act.

And we hope, too, that the engineers — particularly the power engineers of American industry — will never overlook the social and political aspects of the water problem. For, since water is everybody's business, the way to get water problems solved right is to get everybody working on your team. Only through such cooperative action, guided by those who understand the various aspects of water service, can sound results be attained.

To all who will play essential parts in developing better water service everywhere, we offer this report as POWER'S contribution to sound thinking and constructive action.

Power — September — 1952
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330 West 42nd Street, New York 36, N. Y.

Power's DATA SHEET

No. 243

Alloy Steel Pipe—ASTM Specification A-158 Grade P-11 (1¼ Cr, ½ Mo)

Pipe size in.	Nom. OD in.	Wall thick. in.	Temperature – F: To 800	850	900	950	1000	1050	1100	1150
			Maximum allowable stress – psi: 15,000	14,400	13,100	11,000	7800	5500	4000	2500
Schedule 10										
14	14	.250	330	317	288	242	171	121	88	55
16	16	.250	285	273	249	209	148	104	76	47
18	18	.250	256	245	222	187	132	93	68	42
20	20	.250	225	216	196	165	117	82	60	37
24	24	.250	195	187	170	143	101	71	52	32
Schedule 20										
8	8.625	.250	540	518	471	396	281	198	144	90
10	10.75	.250	433	418	380	319	226	159	116	72
12	12.75	.250	360	345	314	264	187	132	96	60
14	14	.312	450	432	393	330	234	165	120	75
16	16	.312	390	374	341	286	202	143	104	65
18	18	.312	345	331	301	253	179	126	92	57
20	20	.375	405	389	353	297	210	148	108	67
24	24	.375	338	317	288	242	171	121	88	55
Schedule 30										
8	8.625	.277	630	605	550	462	327	231	168	105
10	10.75	.307	570	547	498	418	296	209	152	95
12	12.75	.330	540	518	471	396	281	198	144	90
14	14	.375	570	547	498	418	296	209	152	95
16	16	.375	495	475	432	363	257	181	132	83
18	18	.437	540	518	471	396	281	198	144	90
20	20	.500	570	547	498	418	296	209	152	95
24	24	.562	540	518	471	396	281	198	144	90
Schedule 40										
1/2	.84	.109	1698	1627	1480	1243	881	622	452	282
3/4	1.05	.113	1455	1397	1271	1067	756	533	388	242
1	1.315	.133	1579	1512	1375	1155	819	577	420	262
1¼	1.66	.14	1365	1282	930	781	554	390	284	177
1½	1.90	.145	1005	965	877	737	523	369	268	167
2	2.375	.154	920	864	786	660	468	330	240	150
2½	2.875	.203	1215	1186	1061	891	632	443	324	203
3	3.50	.216	1093	1031	956	803	569	401	292	182
4	4.50	.237	975	956	851	715	507	357	260	162
5	5.563	.258	888	850	773	649	460	324	236	147
6	6.625	.28	840	806	734	616	436	308	224	140
8	8.625	.322	765	734	668	561	397	280	204	127
10	10.75	.365	720	691	628	528	374	264	192	120
12	12.75	.406	690	662	603	506	359	253	184	115
14	14	.437	690	662	603	506	359	253	184	115
16	16	.50	705	676	616	517	366	258	188	117
18	18	.562	720	691	628	528	374	264	192	120
20	20	.593	690	662	603	506	359	253	184	115
24	24	.687	675	648	590	495	351	248	180	112
Schedule 60										
8	8.625	.406	1035	994	906	759	538	379	276	172
10	10.75	.50	1065	1022	930	781	554	390	284	177
12	12.75	.562	1035	994	904	759	538	379	276	172
14	14	.593	1005	965	877	737	523	369	268	167
16	16	.656	975	936	851	715	507	357	260	162
18	18	.718	1005	965	877	737	523	369	268	167
20	20	.812	990	950	864	726	515	363	264	165
24	24	.937	1008	965	877	737	523	369	268	167
Schedule 80										
1/2	.84	.147	3030	2908	2646	2222	1575	1111	808	505
3/4	1.05	.154	2595	2491	2266	1903	1349	952	692	432
1	1.315	.179	2595	2491	2266	1903	1349	952	692	432
1¼	1.66	.191	1935	1857	1690	1419	1006	709	516	322
1½	1.90	.20	1815	1742	1585	1331	944	666	484	302
2	2.375	.218	1665	1598	1454	1221	866	611	444	277
2½	2.875	.276	1935	1857	1690	1419	1006	709	516	322
3	3.50	.30	1770	1699	1545	1299	920	649	472	295
4	4.50	.337	1680	1540	1401	1177	834	588	428	267
5	5.563	.375	1470	1411	1283	1078	764	539	392	245
6	6.625	.432	1470	1411	1283	1078	764	539	392	245
8	8.625	.50	1338	1281	1165	978	694	489	356	222
10	10.75	.593	1305	1252	1140	957	679	479	348	217
12	12.75	.687	1305	1252	1140	957	679	479	348	217
14	14	.75	1305	1252	1140	957	679	479	348	217
16	16	.843	1305	1252	1140	957	679	479	348	217
18	18	.937	1305	1252	1140	957	679	479	348	217
20	20	1.031	1305	1252	1140	957	679	479	348	217
24	24	1.218	1290	1238	1127	946	671	473	344	215

Pipe size in.	Nom. OD in.	Wall thick. in.	Temperature – F: To 800	850	900	950	1000	1050	1100	1150
			Maximum allowable stress – psi: 15,000	14,400	13,100	11,000	7800	5500	4000	2500
Schedule 100										
8	8.625	.593	1680	1584	1441	1210	858	605	440	275
10	10.75	.718	1635	1569	1428	1199	850	599	436	272
12	12.75	.843	1680	1584	1441	1210	858	605	440	275
14	14	.937	1695	1627	1480	1243	881	622	452	282
16	16	1.03	1635	1569	1428	1199	850	599	436	272
18	18	1.156	1680	1584	1441	1210	858	605	440	275
20	20	1.25	1680	1584	1441	1210	858	605	440	275
24	24	1.50	1665	1598	1454	1221	866	611	444	277
Schedule 120										
4	4.50	.437	2235	2145	1951	1639	1162	819	596	372
5	5.563	.50	2130	2045	1860	1562	1108	781	568	355
6	6.625	.562	2040	1958	1781	1496	1061	748	544	340
8	8.625	.718	2070	1987	1808	1518	1076	759	552	345
10	10.75	.843	1980	1900	1729	1452	1030	726	528	330
12	12.75	1.00	2010	1930	1755	1474	1045	737	536	335
14	14	1.062	2010	1930	1755	1474	1045	737	536	335
16	16	1.218	1980	1900	1729	1452	1030	726	528	330
18	18	1.343	1995	1915	1742	1463	1037	732	532	333
20	20	1.50	1965	1886	1716	1441	1021	721	524	327
24	24	1.75	1995	1915	1742	1463	1037	732	532	332
Schedule 140										
8	8.625	.812	2585	2390	2082	1749	1240	875	636	397
10	10.75	1.00	2400	2304	2096	1760	1248	880	640	400
12	12.75	1.125	2295	2203	2004	1683	1193	842	612	383
14	14	1.25	2340	2246	2043	1716	1216	858	624	390
16	16	1.437	2370	2275	2070	1738	1232	869	632	395
18	18	1.562	2310	2218	2017	1694	1201	847	616	385
20	20	1.75	2340	2246	2043	1716	1216	858	624	390
24	24	2.062	2310	2218	2017	1694	1201	847	616	385
Schedule 160										
1/2	.84	.187	4545	4363	3969	3333	2363	1666	1212	758
3/4	1.05	.218	4500	4320	3930	3300	2340	1650	1200	750
1	1.315	.25	4390	4118	3746	3146	2231	1573	1144	715
1¼	1.66	.25	3880	3880	3629	3048	2160	1100	800	500
1½	1.90	.281	3896	3965	3698	3265	1606	1133	824	515
2	2.375	.343	3325	3096	2816	2363	1677	1182	860	538
2½	2.875	.375	2976	2851	2594	2178	1544	1089	792	495
3	3.50	.437	2940	2822	2567	2156	1528	1078	784	490
4	4.50	.531	2865	2750	2502	2101	1490	1088	764	477
5	5.563	.625	2790	2679	2436	2046	1450	1023	744	465
6	6.625	.718	2730	2621	2384	2002	1419	1001	728	455
8	8.625	.906	2735	2603	2371	1991	1411	995	724	452
10	10.75	1.125	2760	2650	2410	2024	1435	1012	736	460
12	12.75	1.312	2730	2621	2384	2002	1419	1001	728	455
14	14	1.406	2670	2563	2332	1958	1389	979	712	445
16	16	1.562	2670	2563	2332	1958	1389	979	712	445
18	18	1.75	2670	2563	2332	1958	1389	979	712	445
20	20	1.937	2655	2550	2318	1947	1381	974	709	443
24	24	2.312	2655	2550	2318	1947	1381	974	709	443

Maximum Allowable Working Pressure—2

► HERE'S THE SECOND of six handy data sheets to speed up selection of pipe sizes. The first appeared in July 1952, POWER, p 99. These tables are especially helpful in avoiding error in pipe design calculations.

Tables are based on allowable stresses published in the August 1951 issue of *Mechanical Engineering* and the p/s values given in the Crane Co catalog No. 49.

BY GEORGE C HALZEL *Boston, Mass.*

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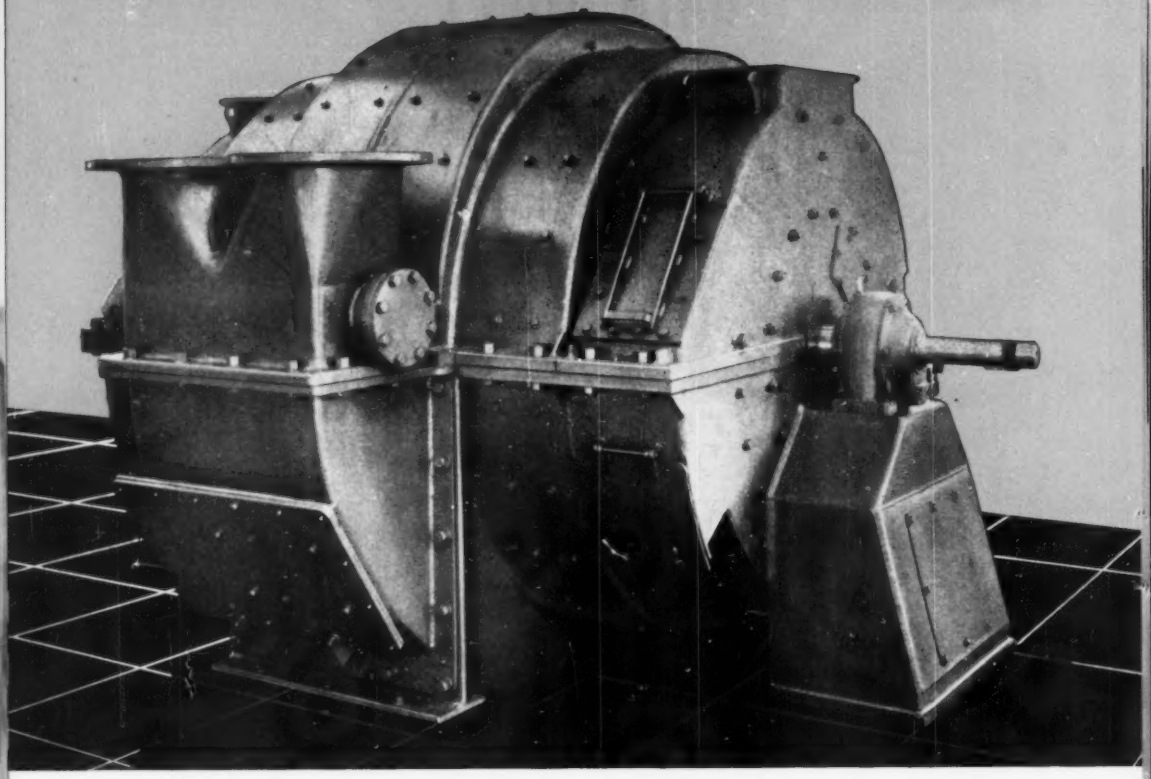
Performance of Riley "50" Pulverizers



Riley "50" Pulverizers give you all these other significant advantages . . .

Quiet vibrationless operation
Flexibility—wide load range
Ability to carry extremely low loads
Low power consumption
Ease of regulation
Small space required
Minimum foundation cost
Parts easily renewed
Can be operated without coal feed
Ease of ignition
Low lubrication cost
No worms or gears—Just two bearings
High primary air temperatures
Low maintenance

The Riley "50" Pulverizer is the latest development in the coal pulverizing field. It is the only pulverizer using tungsten carbide parts to assure long periods of continuous operation and low maintenance. It will pay you to investigate Riley "50" Pulverizers when considering this type of equipment.

TRADE MARK Rx REGISTERED

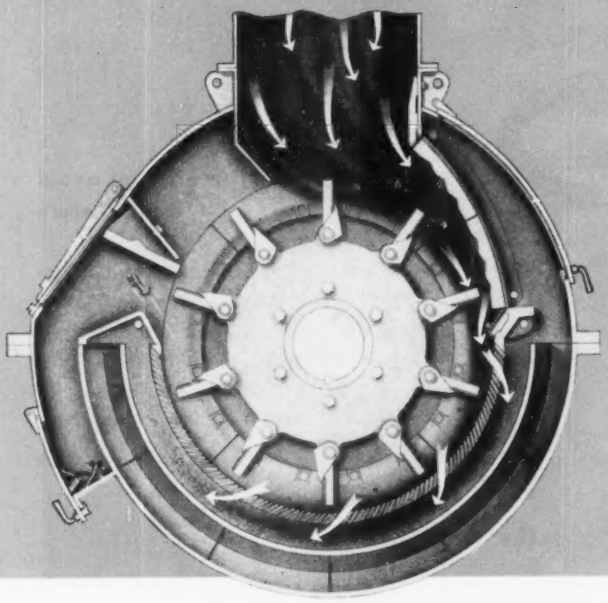
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Charlotte Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

not affected by Increase in Moisture



This Crusher-Dryer Stage Does the Trick

Both field and laboratory tests have conclusively proven that moisture content of coal does not affect performance of Riley "50" Pulverizers and that capacity is not decreased with an increase in moisture provided primary air temperatures are adequate. Coals with free moisture up to 15%, which is about the free moisture limit that coal can retain, have been satisfactorily pulverized.

The ability of Riley "50" Pulverizers to handle such high moisture coals without capacity reduction is due to the performance of the crusher-dryer section of the Riley "50" Pulverizer. In this first stage, the free moisture is evaporated and the coal crushed to a fine granular state so that coal passing to final pulverizing stage is free of surface moisture.

Ask users of Riley "50" Pulverizers—they will tell you that moisture of coal means nothing to their Riley "50" Pulverizers.

All of these people have ordered Riley "50" Pulverizers within the past two years.

PUBLIC UTILITIES

Detroit Edison Co.
Iowa-Illinois Gas & Electric Co.
Monongahela Power Co.
Utah Power & Light Co.
Hartford Electric Light Co.
Public Service Co. of Colorado
Iowa Electric Light & Power Co.
Northern States Power Co.
The Potomac Edison Co.
Superior Water, Light & Power Co.
Western Colorado Power Co.
South Carolina Public Service Authority
Corn Belt Power Cooperative
Central Ohio Light & Power Co.

MUNICIPAL PLANTS

City of Richmond, Indiana
City of Holyoke, Mass.
City of Rochester, Minn.
City of Owensboro, Ky.
City of Austin, Minn.

INDUSTRIAL COMPANIES

Carbide & Carbon Chemical Co.
Goodyear Tire & Rubber Co.
Western Electric Co.
General Electric Co.
Hooker Electrochemical Co.
North American Aviation
The Ohio Oil Co.
National Supply Co.
Continental Can Co.
Monsanto Chemical Co.
St. Croix Paper Co.
Celanese Corp. of America
Owens-Corning Fiberglas Co
Pittsburgh Plate Glass Co.
Lawless Bros. Paper Co
U. S. Finishing Co.
Bell Aircraft Co.
Syracuse University
U. S. Steel Company
Riegel Textile Corp.
White Pine Copper Co.
Ciba States Ltd.
Great Lakes Naval Training Station
Boston Navy Yard
Ashland Oil & Refining Co.
Ruberoid Co.

ENGINEERED BY THE FOLLOWING CONSULTANTS

Stone & Webster Engineering Corp
Ebasco Services
Sargent & Lundy
Ford, Bacon & Davis, Inc.
Chas. T. Main, Inc.
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United Engineers & Constructors
Jackson & Moreland
Bechtel Corporation
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Black & Veatch
Stanley Engineering Co.
Douglas M. McBean
Robson & Woese, Inc.
Francisco & Jacobs
Burns & McDonald
Kenneth R. Warrington
J. V. Edeskuty
Robert S. Curl & Associates
Interboro Company
Catalytic Construction Co.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

It's better to get *all* your valves from ONE source

Because when you do this you avoid

— **the confusion that accompanies stocking spare parts for valves of several different makes.**

— **the multiple stocking of valves and parts because different makes are not interchangeable.**

— **the needless complications that confront your maintenance department in making repairs.**

— **the chance that some valves are not backed by adequate manufacturer's engineering services.**

The Powell Line is so complete that you *can* get all your valves from one source.

The Wm. Powell Co.
Cincinnati 22, Ohio

Fig. 16003 W. E.
600-pound Cast Steel Pressure Seal Gate Valve with welding ends.
A Powell design for the modern Power Plant.
Also made for 900, 1500, and 2500 W. S. P.

In the new Walter C. Beckjord Power Station of the Cincinnati Gas & Electric Co., Powell Cast Steel Pressure Seal Valves are installed in all high pressure-high temperature steam lines.

POWELL

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES

DEPENDABLE VALVES SINCE 1846

D F STEINKE, Director, Power Educational Dept, and author of this article, teaches the operators in large, new, modern classroom

'IT PAYS TO TRAIN OPERATORS'

says Dow Chemical Co

and this curriculum does it

ALL DEPARTMENTS

1 Orientation course (non-credit course); prerequisite for all new employees (4 weeks)
2 Advanced reading (4-week non-credit course)

OPERATING DEPT

Firemen

1 Burner and pulverizer (24 weeks)
2 Feedwater equipment (24 weeks)
3 Cyclone boiler (15 weeks)

Engineers

Prerequisites: All firing courses except class "A" engineers and dispatchers
1 Steam turbines and generators, Part 1 (20 weeks)
2 Steam turbines and generators, Part 2 (24 weeks)

Coal handlers

1 Coal-conditioning course; self-taught reading course

MAINTENANCE DEPT

Prerequisite: Burner and pulverizer
1 Power maintenance Part "B" (32 weeks)
2 Power maintenance Part "A" (36 weeks)

INSTRUMENT AND CONTROL DEPT

Prerequisite: H-s graduate physics or chemistry for No. 3
1 Electrical (48 weeks)
2 Instrument (48 weeks)
3 Water conditioning (48 weeks)

► At Dow Chemical Co, we manufacture industrial and pharmaceutical chemicals and produce magnesium metal, in this country and Canada. Our power plants serve process with high-pressure, low-pressure and vacuum steam—also with electrical energy, compressed air, high- and low-pressure water and stack gas.

Several of our power plants are synchronized with public utilities. Power is purchased or sold, depending on local conditions. So we must select and operate specialized equipment. That calls for putting into use advanced ideas in power-plant work.

Objectives. Plants are no better than the personnel operating them. As we have service to sell, it's our job to qualify our men, same as any other company department, for doing a more efficient job. It's very hard to evaluate such a training program. To be successful, it must be conceived and carried

out honestly and efficiently, under proper conditions.

Problems. Shortly before the last war ended, our power department faced a new problem. To expand our facilities and produce enough electricity and other power facilities by 1952 to meet our daily requirements, we had to train personnel to operate equipment we were developing.

Expansion called for operating complicated power equipment of entirely new conception, like the cyclone-type boiler.

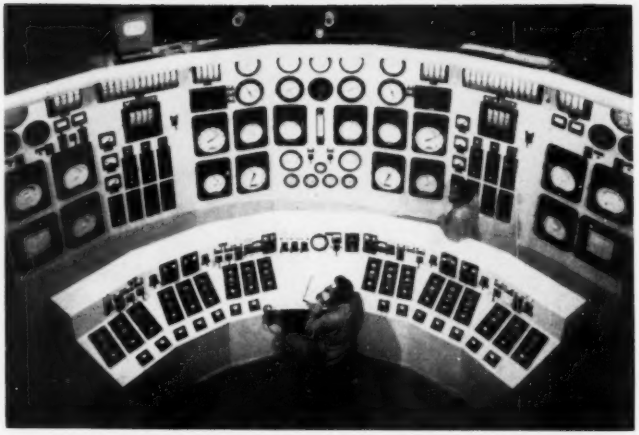
Union Agreement. That called for a vast amount of cooperation from management, the working man, various educational departments and the local union. An educational committee was composed of upper management, and a program planned. Here are policies adopted: (1) Courses were to pertain closely to Dow problems and equipment, except electrical and instrument courses of highly technical nature. (2) First group to take courses were to be selected on basis of seniority. Later course to be open to all requiring such training. (3) Start with most needed course in firing. Later, extend curriculum to engineers, instrument, maintenance and laboratory men. (4) A member of power-department management was to plan and give first instruction.

Program was a step in right direction, but no one in power department had time to carry out all these policies. Outside instructor was needed on a part-time program. After several attempts, it was found that courses and classes were too limited.

Committee found that a full-time engineer instructor was needed. Also that favoritism could be avoided if the educational department corrected all the papers.

Program Expanded. Program was adopted in fall of 1945, with a full-time director to be employed. Committee wanted a practical and experienced person who understood power-plant problems, someone outside the company. I was finally selected, attached to the educational department, and loaned to the power department. Before long the program was placed in operation. That same year we selected a class room centrally located to all power plants, and made ready for first two firing courses.

The director, with help of educational department, is responsible for textbooks, models, visual aids, and general policy regarding classroom conduct. Power educational committee determines number of trainees, courses to be given, procedure in regard to drop-outs, minimum grades, job progression and union agreement as concerns trainees.



CONTROL PANEL for two cyclone boilers of 1250 psi is modern, requires skilled operators. Cyclone boiler course was developed to include this type power equipment

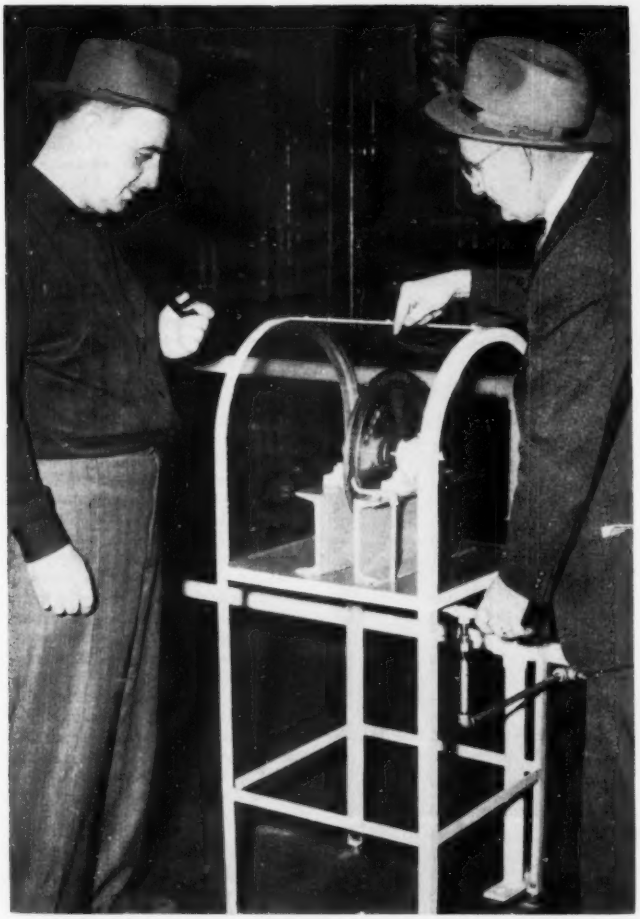
FIRST CLASSROOM got cramped as courses became popular with these experienced operators. Newer men were easily sold so now we use large classrooms instead

Operating highly complex power equipment...

Program did not start in usual way of handing out textbooks to students. Instead, we started a practical, on-the-job type of training. Textbooks and other aids were so designed that trainees received them eagerly.

Before formal classroom work began, trainees were given "feel" of things. Short review courses or movies brought them up to date. In an atmosphere of relaxation — on company time—they saw films on power generation. The committee feels these preliminaries kindled the "spark" that encouraged the first group with right attitude to make this program an outstanding success.

Curriculum, Courses. In 1946, the program was expanded to include all operating, maintenance, instrument and control personnel. Curriculum, shown on p 123, was adopted. This program seemed to fit our needs, but was too large to run all at one time. So the following courses were given from this curriculum the second year: burner



TURBINE MODEL used for power educational program is examined by W H Sutliff, supt of power maintenance, and L J Hebert, plant engineer. Many working models used

...calls for training responsible personnel

& pulverizer, feedwater equipment, electrical course, water-conditioning course, power maintenance, part "B."

For supervisory training, a course was developed in foremanship two years later. Then present supervisory program was developed.

With a new subject every day, and each student attending two hours per week, instructor was overworked. By 1947, with 240 students enrolled in all courses, another part-time instructor was added and program expanded along with power facilities. We created a modern training center, with two classrooms that can serve as an auditorium.

Grading, Recognition. All classes meet once each week on company time, for two hours. Each student is assigned two hours home study. Students on off-shift time are paid time and one half if required to attend class. Passing grade is 70% for all courses. Student passing is made present of all books and instruction material loaned him during course. Besides, he gets a registered certificate at completion. Visiting outstanding power plants in our area adds further incentive.

Only when an educational program embraces all personnel and management will a group work as a team to extend their know-how. Only then can a vast expansion program, new to each one, be successful.

Union Agreements, Promotions. Textbooks and visual aids must be tailor-made by the instructor. This helps both instructor and teaching material to conform to company's problems. Before starting such program, procure a union agreement suitable to conditions to tie in with job progression.

Our present agreement requires each employe to take a course related to his classification before advancement, regardless of seniority.

Training Techniques. We use every type of visual aid that does the job. Included are huge wooden micrometers, or other instruments. Cutaway models of valves, small turbines, parts of turbines, parts of boilers, soot blowing heads, etc, help us succeed.

Help in Developing Program. Our suppliers and contractors have been most helpful with teaching aids. We repay them by exchanging information and ideas we develop. Through this program we have developed into more than an educational department. Also, we help employes publish technical papers. And we help correlate ideas and instructions for new equipment being installed.

Instruction material is circulated between the engineering department, the operating department and the construction contractor. We help to stimulate and procure suitable publicity for our personnel and equipment.

Besides our present curriculum, we have added a course for orienting new employes. Course has four sessions, two hours long, and acquaints students with our department, communications, rules and regulations, tagging procedures, industrial and social benefits, along with simple diagrams of steam, water, air, electric and fuel lines.

We also planned a course on switchboard and control designed for our dispatchers. Also another short non-credit course in advanced reading.

We run 90% of our curriculum with two full-time and two part-time instructors. About 1100 trainees have graduated from all our courses; 80% of our students complete their course.

Our training program has cost considerable money, but it's a minor item compared with our gigantic investment of equipment to be maintained and operated efficiently. Therefore, program is a necessity, not an auxiliary.

BOILER-WATER SAMPLING and measuring arrangement merits special attention so that you always get good, nondiluted, representative samples—first step in control

Continuous Blowdown Proves Big Money-Saver

Boiler alkalinity with zeolite-softened feedwater can climb to where manual blowdown loses control. Here's one answer

A H GIPSON, *Engineer, Factory Planning, Western Electric Co*

► CONTINUOUS BLOWDOWN SYSTEMS have proved their worth in many medium-sized boiler plants. Usually, though, the full extent of their advantages is lost because of inadequate before-and-after data.

The Allentown, Pa., plant of Western Electric Co houses three 20,000-lb-per-hr 3-drum boilers that supply heating, air-conditioning, and industrial steam for a modern electronics plant, POWER, January 1949, pp 64-67.

We equipped the plant with everything sound engineering could justify. But with the size of the boilers selected and our steaming load we felt manual blowdown would prove adequate for water-condition control. Experience showed it was not.

Blowdowns grew to a total of 18 a day and averaged about 300 gallons each. Without this quantity of blowdown, boiler alkalinity from incoming zeolite-softened feedwater got out of hand. But to keep alkalinity within limits we were paying heavily in (1) heat loss and (2) treatment chemicals. Our blowdown went directly to a blowdown tank and then to the sewer without heat recovery. The 5000 or so gallons we were blowing to waste had to be replaced with treated water and, in effect, added to the load of the softeners in the way of increased costs in salt, zeolite and labor. What's more, the blowdown carried with it a high percentage of boiler chemicals.

On top of these difficulties we faced the extra problems brought on by heavy makeup. To begin with, the cold makeup water, ranging from 49 to 52 F, sometimes chilled the deaerator to where it could not do its rated job. Also, it carried mud and other impurities that added to blowdown and chemical treatment loads. Further, it carried very heavy amounts of dissolved oxygen that needed cleaning up in our unbalanced treatment system. With an overloaded deaerator we had to go to more sulfite additions. As a result we had to run with water extremely high in chemical concentrations—above and beyond that needed to correct for boiler purposes—because we had to be sure enough protecting chemicals remained behind even after the heavy blowdowns. All in all, it was a vicious circle.

Continuous Blowdown. Our only way out was to go to a continuous blowdown system. That system was to include collecting pipes, control panel, flash tank, pressure equalizer, heat exchanger, cock for test samples and pot for measuring blowdown—with, incidentally, a chemical feed pump to go in at the same time. All this equipment had to fit into the existing boiler-room layout, already well-filled.

The 1¼-in. collector pipes are of wrought iron, 8 ft long, perforated with drilled holes. We hung them in the water spaces of the steam drums. Then we piped them to the control panel where we have (1) needle valves to throttle flow (2) gate valves to shut off other boilers while one is being timed.

At the discharge side of the panel all lines join in a header that ties directly to the flash tank.

The flash tank, which we baffled to separate flash steam, discharges into the deaerator where it supplies needed heat and restores evaporated water. The remaining blowdown water, concentrated by about 10% from the loss of flash steam, discharges to a loop seal that equalizes system pressure between deaerator and atmosphere. This loop seal connects to a counterflow heat exchanger where heat from the blowdown is given up to incoming makeup. Under our old heavy blowdown operation we provided hot-water storage in this heat exchanger because it was the only place we could smooth out the effect of the heavy intermittent makeup demand. Our condensate system operates from a relatively large sump.

With our new continuous blowdown system the cooled water leaving the heat exchanger carries through a line equipped with a sample cock just ahead of a siphon trap. From this cock, we pull boiler-water samples. The siphon trap discharges to the sewer through a valve line whose output can be diverted to a one-gallon pot. The time it takes to fill this pot measures the blowdown rate, and we record it in seconds per gallon for simplicity rather than the usual gallons per second.

This special sampling and measuring arrangement grew out of our dissatisfaction with the old one where we drew samples from the water column. The water columns gave samples that were hot, and open to air contamination and liable to dilution from condensation above the water level. Our new arrangement, photo, facing page, meets all these objections and permits correcting for concentration from flash because blowdown is constant.

The measuring pot eliminates all the errors from trying to judge blowdown by reading the gage glass. What's more, it avoids the danger of tripping the low-water cutoff from too heavy a drawdown. Now the only chance this will happen is confined to a routine blowdown of sludge or water columns.

For safety reasons we put no valves past the throttling valves. Thus flow can't be stopped and pressure built up from this cause. The leg going to the sewer is exposed to the atmosphere at the measuring pot and the one connecting to the deaerator draws its protection from the deaerator's 15-psi safety valve. A liberal use of plugged crosses and tees in the blowdown piping gives built-in safeguards for handling any plugged-up sections. We selected reasonably small, well-insulated lines to hold heat loss as low as possible.

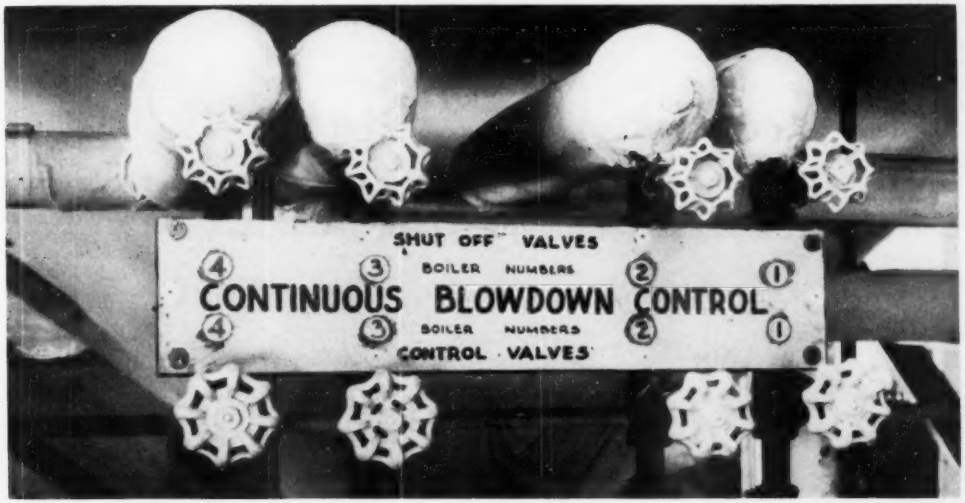
Chemical Feed. Along with our continuous blowdown we felt it advisable to put in a continuous chemical feed. To get this feed we designed two simple reciprocating pumps with enough displacement to meet all demands. We put these on the existing duplex boiler-feed pumps and control them by the varying speed of the boiler-feed pump. We meet any additional control needs in one of two ways: (1) We change the drive-arm position on the duplex pump's valve lever. (It is at this point that the chemical feed pumps get their drive power.) (2) We dilute the feed's chemical strength.

Operating Results. Six months' observation shows big savings in both water (about 3500 gal daily) and chemicals. The credit, we feel, belongs to control over blowdown quantities, plus maintenance of optimum concentrations in the boiler.

Deaerator operation is far better. Flash-steam return and preheated makeup share this success. The deaerator now takes less line steam, holds to a uniform 215 F, plus or minus 3 degrees, against a previous 20 to 30 F dip when large, periodic makeup was drawn, passes much less residual oxygen in leaving water.

It's obvious from these definite results that we're enjoying considerable savings in heat. We used to lose 5000 gal of water daily at boiler temperature. Today we send out 1500 gal at an average of 70 F with a resultant saving of around 10,000,000 Btu. At our operating boiler efficiency this equals two barrels of oil a day out of a daily average consumption of 40 barrels.

The combination of continuous blowdown and chemical feed has cut our former annual chemical-treatment costs about in half. Along with this saving, boiler inspection shows clean surfaces, no scale or mud build-ups anywhere.

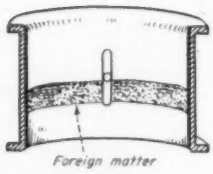


CONTROL PANEL for continuous blowdown system features needle valves installed to throttle flow. Gate valves to shut off other boilers while one is being timed, plus common header tying directly to flash tank, make operation simple, easy

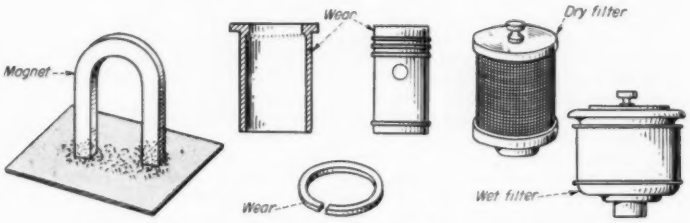
OPERATORS' NOTEBOOK 56

Quick Way to Shoot Your

DIRTY?—CHECK STRAINERS AND WEAR

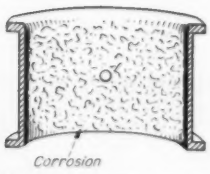


EMBEDDED foreign matter found in the soft bearing metal may be either metal or foreign particles

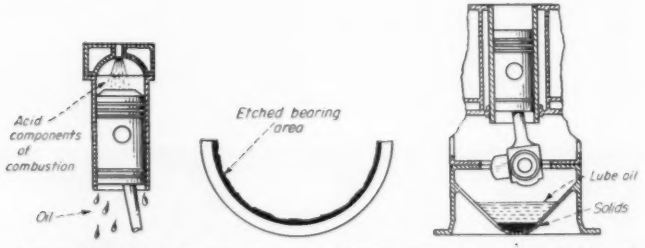


MAGNET tells if matter is metallic. If so, check liners, pistons, rings for excessive wear. If not metallic, check air filters for foreign particles being drawn into cylinders. Grit in bearing metal scores shafts, increases bearing clearance, causes overheating

CORRODED?—STOP OIL CONTAMINATION

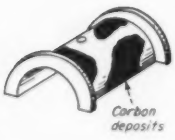


FATIGUE and corrosion are often difficult to tell apart. Both are very hard on the bearing lining



ACID COMPONENTS of combustion and condensed water vapor collect in lube oil, cause corrosion. Affect all bearings alike. Etched bearing surface reduces effective bearing area, causes failure from high unit pressure if not corrected soon

LOOSE?—HAVE GOOD 'CRUSH' FIT



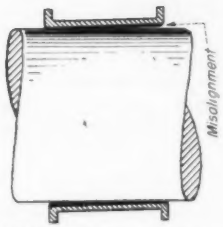
CARBON deposit on back of shell advertises that the bearing shell is loose and in need of correction

CHECK by placing straightedge on bearing, insert feelers at 1, 2, 3. Shell must have "crush" fit at these points. Loose shell may turn, cut off oil supply. Relief at parting edges cares for swelling; they give oil storage for good operation

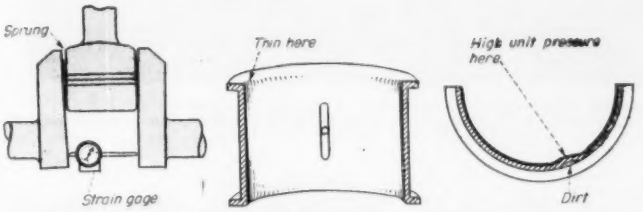
Diesel Bearing Troubles

By STEVE ELONKA, *Associate Editor*

MISALIGNED?——MAKE STRAIN GAGE TEST

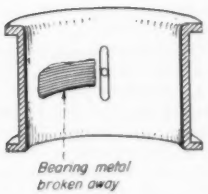


MECHANICAL cause is often from misalignment. That deforms bearings, causes high-pressure areas

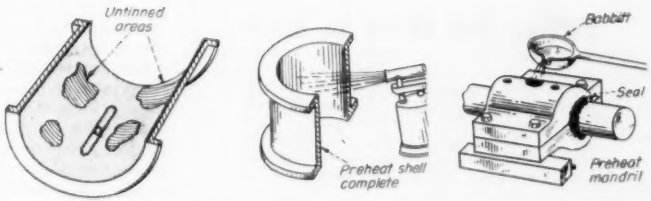


CRANK BEARINGS' misalignment is found with strain gage (Oprtrs Ntbk Sept '51). Distorted crankshaft may break if not found in time. Bearing-shell distortion is also from foreign particles under thin bearing metal; then heating affects bearing

BOND FAILED?——TIN AND BABBITT CORRECTLY

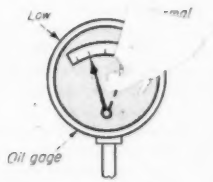


BOND FAILURE causes the thin pieces of the soft bearing metal to break away from the bearing shell

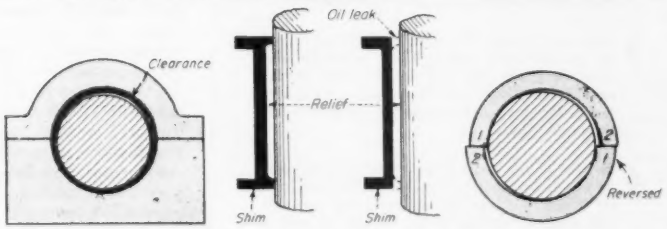


UNTINNED shell areas before babbitting are chief bond-failure cause. Improved methods make this fault uncommon in modern bearings. When tinning shell, preheat carefully and tin completely. Also preheat mandril and shell to right temperature

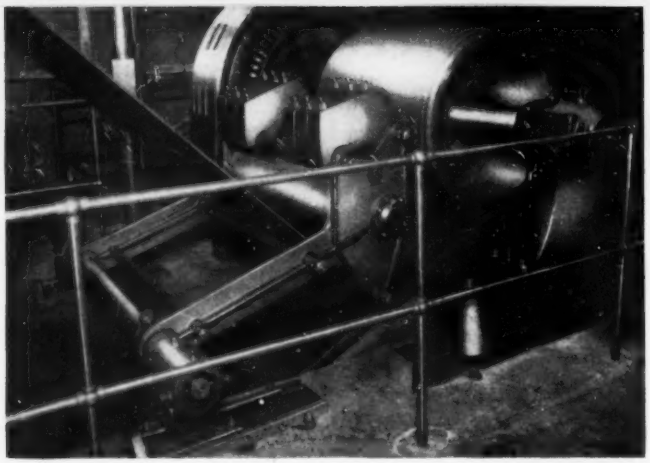
OIL PRESSURE LOW? TAKE UP ON CLEARANCES



LOW OIL pressure will be hard on the bearings. Keep the pressures that the manufacturer recommends

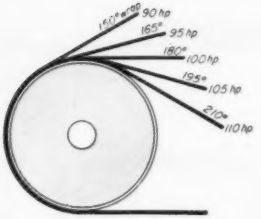


EXCESSIVE bearing clearance oozes badly needed oil, lowers pressure, makes engine noisy. Heavily loaded bearings may even fail. Shims must seal bearing halves at relief ends, but not touch to scrape oil off shaft. Reversed shells may leak oil



OLD-TIME IDLER installation that ran afoul of rules listed below. Idler is too close to smaller pulley and its diameter is too small; the belt makes a heavy reverse bend

Belt Wrap and Belt . . .



BELT CAPACITY increases or decreases 5% for each 15 deg change in belt wrap

Get Better Use From Your Belt Idlers

Putting Belt Idlers to Work

When idlers are properly applied and adjusted they permit heavier loads with same belt width and speed. Idlers make short-center space-saving drives more efficient. Other advantages: reduced belt slippage, increased belt life since belt operates with less tension, greater wrap. Here are 4 pointers.

1 **Select idler as large or larger than small pulley. This reduces effects of reverse-bending the belt around the idler.**

2 **Use a flat-surfaced idler. With crowned idlers belt will flex in opposite transverse direction in passing from small pulley to idler. And since idler is close to small pulley, change in direction of flexing further aggravates destructive effects of belt bending.**

3 **Allow for maximum arc of contact on small pulley. Do this with idlers, making belt long enough so it takes an ample wrap around small pulley leaving safe allowance for stretch. Remember, as arc of contact is decreased, belt tension must be increased to drive same load.**

4 **Set idler so belt length between idler and small pulley equals belt width. If idler is too far from pulley it cuts belt wrap. If too close, wrap increases with load but bending stresses in belt are severe.**

► LOOK UPON the flat leather belt as a type of friction drive. It's just as dependent on the laws of friction as the clutch or brake. Friction can be defined as the force that resists moving one surface over another. It's this frictional force that makes the pulley drive the belt and keeps belt from slipping. And friction is linked with belt tension.

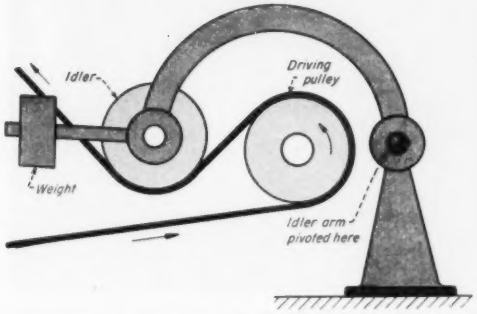
Belt Tension does two things: (1) It holds belt snug against pulley creating the force required of any friction drive. (2) When belt tension is uneven on both sides of pulley (as it must be under load) there is a tendency to pull belt around the pulley. As belt tries to move around pulley, friction between surfaces tends to move pulley with belt. If belt friction is too small, belt moves without turning driven pulley and you have true slip.

You can lick this slip by (1) pressing belt harder against pulley—increasing tension on both sides of belt (2) using belt or pulley with higher coefficient of friction. If tension on tight side of belt cannot be further increased over that in slack side without breaking fastenings or undue stretching, use a thicker or wider belt. Belt must stand up under strain of driving and strain of holding itself against pulley. *Force a belt exerts in turning a pulley is difference in tension between tight and slack side of belt.* This difference, the resultant tension, is called the *effective tension.*

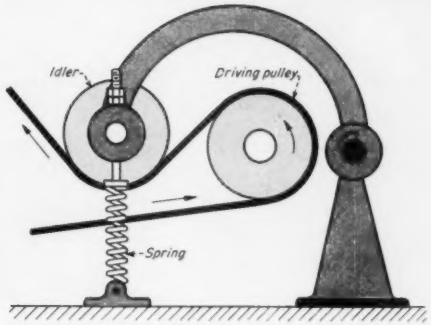
To drive this point home let's say tension is 160 lb on tight side and 50 lb on slack side. Effective tension is then 160 – 50, or 110 lb. If belt speed is 2000 fpm, power transmitted by it is (110 × 2000) ÷ 33,000. This works out to 6.66 hp. That 33,000 is the number of ftlb in 1 hp.

Belt Wrap. Now let's see how belt wrap (arc of contact) links in with tension and friction. For a given pulley and a given belt, wrapped for a given arc around the pulley, low-side tension is a fixed fraction of high-side tension. When you get right down to it, the flat-belt drive is a sort of tug of war. Belt transmits power only to the extent that tight side is tighter than slack side.

. . . Tension Are Held at the Best Operating Point by Properly Applied Idlers

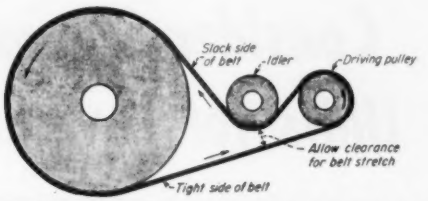


GRAVITY-TYPE floating idler has adjustable arm. Total weight of idler keeps the unit from bouncing under sudden belt loads



SPRING-LOADED idler floats on belt's slack side. Keep idler size equal to or greater than diameter of the small pulley

Most new short-center flat-belt installations have automatic motor bases rather than idlers for tension control. But many idlers still in use will do a better job with these time-proven tips



CORRECT LOCATION for idler is on belt's slack side. Place idler so belt length between idler and pulley equals belt width

As a case in point, take an average leather belt and cast-iron pulley. If angle of wrap is 180 deg, belt starts slipping heavily when slack-side tension drops to about 44% of tight-side tension. This drop in slack-side tension is automatic as drive is loaded. At no load, tension equal on both sides.

This 44% holds for all pulley diameters, belt widths, and thicknesses within reason. It varies only as friction coefficient varies for different leather and pulley surfaces.

Carrying More Load. You may have a drive that just won't carry its present load efficiently. In many such cases it may be possible to increase arc of contact on offending pulley by slackening belt, increasing center distances, changing slack side from bottom to top (on long horizontal runs) or by adding an idler. Above three sketches show three ways of installing the idler that have worked out well in the past.

How much can you gain by increasing belt wrap with an idler? A good rule of thumb is to add or subtract 5% of power being transmitted for each 15 deg that the angle of contact exceeds or falls short of 180 deg.

Belt Speed. Tension plays another part in addition to creating friction and effective tension. It must counteract belt's tendency to fly off pulleys through centrifugal force. A belt moving 5000 fpm is traveling nearly 60 mph. It approaches a pulley at this high speed. Then in a split second belt is turned around the pulley to run at this same high speed in the opposite direction.

As belt drive is speeded up, increasing centrifugal tension tends to enlarge belt in all directions. This reduces belt pressure on pulleys, decreasing capacity of belt to transmit power. At excessive speeds, belt may actually become too large for the drive, dropping off the pulleys. Centrifugal force in a belt increases as square of belt speed and directly as belt weight. That's why you use lightweight belts for high-speed drives.

Idlers at Work. As mentioned above, proper belt tension and belt wrap are two essentials of any drive. Manufacturer cannot sell them; they're completely under your control.

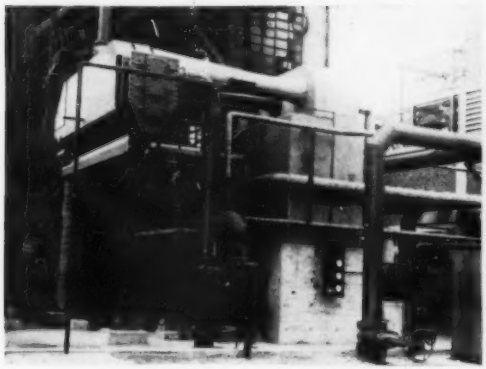
A time-honored rule for getting proper tension is to measure, with a tape line, length of belt needed to connect the two pulleys. Then deduct ⅛ in. for each foot of belt. This rule works fairly well for long drives since belt elasticity makes takeup necessary only at fairly long intervals.

But today many flat leather belts operate on short centers. They often have some automatic takeup for tension control. Automatic motor bases are generally used to fill the bill. But, as sketched above, a floating idler pulley will give you automatic tension and take up control. Or the idler can be pressed against belt by weight or spring.

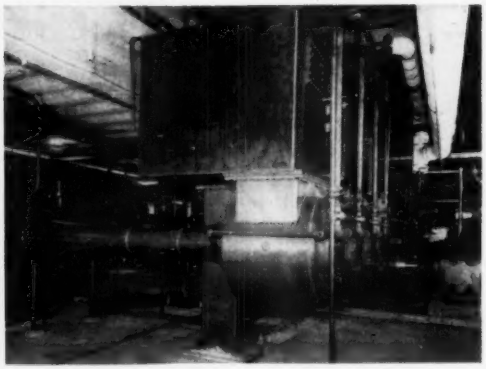
Besides controlling tension the idler increases belt wrap. This means belt can deliver more hp. Further, by adjusting idler position you can correct some pulley misalignment. This is handy with wide flat belts that may not hold in line with slightly crowned pulleys, or where the belt may be damaged by excessive pulley crowns.

Belt "Killers." You may have heard that some idlers are belt killers. This is true if they're not properly installed and adjusted. A first-rate installation has idler on slack side of belt. Idler loading is adjusted to put maximum required tension on belt to drive the maximum load without slipping. As load increases, stretch on tight side is transferred to slack side. Then idler drops to lower level depending somewhat on belt stretch. This idler action holds slack side tension practically constant, plus increasing arc of contact on small pulley to give more driving power.

Idlers are an older method of maintaining tension. As pointed out on pp 118-119, Jan 1952 POWER, automatic motor bases play a big part in today's belt-tension picture.



1 This 425-ton steam-jet water-vapor refrigeration unit is one of five helping to make butadiene in a process plant

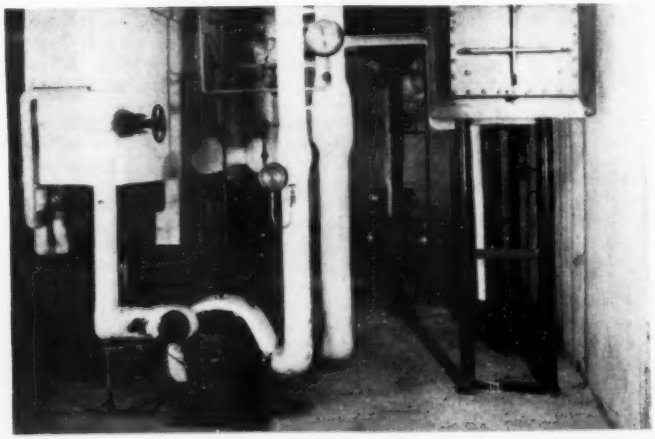


2 Here are two 600-ton steam-jet units used for air-conditioning in large municipal auditorium. Units are indoors

Consider Steam-Jet Refrigeration Units for Low-Cost Water Chilling

When you need chilled-water temperatures of 35 F or higher, steam-jet refrigeration may be your answer. Here's a quick look at steam-jet units, how they work and where to use them

By C F SWEET, *Engineer, Ingersoll-Rand Company*



6 This steam-jet unit, rated at 150 tons, has both a turbine-driven chilled-water pump and a reciprocating circulating-water pump. Unit is in a large hospital

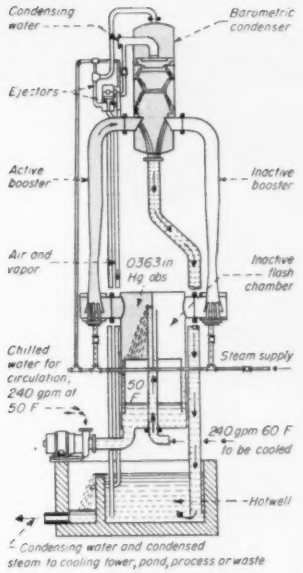
► IF YOU RUN comfort-cooling, air-conditioning or process-cooling systems, you're likely to bump into steam-jet refrigeration one of these days. So tag along with us for some sure-fire tips on this modern, simple and safe way of cooling for industrial and commercial jobs.

How It Works. We all know that water boils at 212 F at atmospheric pressure, 14.7 psia. Lower the pressure on water surface, and boiling point goes down. At 10 psia it is 193 F, at 5 psia 162 F, at 1 psia 101 F. Pull the pressure down to 0.25 in. mercury and water boils at 40 F. This is low enough for some refrigeration jobs.

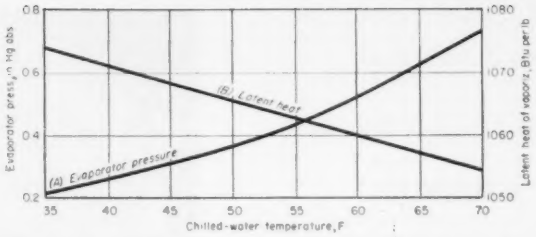
Fig. 3 shows a typical modern steam-jet unit. Water at 60 F from cooling system enters flash chamber in which pressure is 0.363 in. mercury. This corresponds to a boiling point of 50 F. Excess heat in 60-F water makes part of water flash to steam (vapor). Water temperature falls to 50 F.

Booster ejector removes steam from flash chamber, compresses it to a higher pressure before it is condensed in barometric-type booster condenser. Pressure in booster condenser runs from 1½ to 2½ in. mercury for usual condensing-water temperatures.

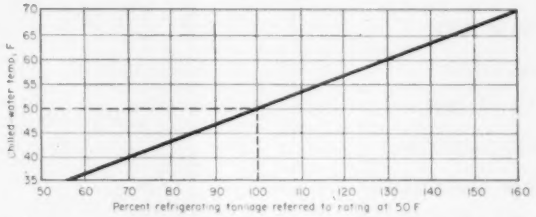
All vapor from chamber and booster-ejector steam condenses in booster condenser. Since this condenser runs under vacuum, air-removal equipment of some



3 Barometric-type steam-jet unit has 100-ton output, is easily regulated


Evaporator press., in Hg abs
Latent heat of vapor, Btu per lb
(B) Latent heat
(A) Evaporator pressure
Chilled-water temperature, F

4 Chilled-water temperature varies with evaporator pressure, curve *A*. Heat removed from water by evaporating 1 lb varies with water temperature, curve *B*



5 Steam-jet refrigeration units have large overload capacity when chilled-water temperature is increased. Capacity of unit here is based on 50-F outlet temp

sort is needed. This is usually a small 2-stage air ejector, Fig. 3.

Arrangement. Unit in Fig. 3 cools 240 gpm 10 F, has a capacity of 100 tons. Barometric condensers are good where low first cost is desired, condensate recovery isn't important, and there's enough headroom. They are also good where condenser water is dirty. Barometric leg must be 34 ft high because water is drained by gravity.

Barometric-condenser units are often installed outdoors so height is no problem. Foundation is simple, low cost.

Surface instead of barometric condensers are good where height or condensate recovery is important. Installation is either indoors or outdoors.

Refrigerant. Water is the only refrigerant used in steam-jet systems. Since it is circulated for cooling, temperature is always above 32 F. So you'll find steam-jet units applied to jobs where temperatures higher than subfreezing are suitable.

Each pound of water evaporating in flash chamber needs about 1000 Btu. This heat comes from remaining water. Making one pound of vapor cools 100 lb of remaining water 10 F; or 50 lb of remaining water is cooled 20 F.

One ton of refrigeration is heat removal at the rate of 12,000 Btu per hour. So evaporation of a little less than 12 lb of water per hr in flash chamber gives a unit with 1-ton capacity.

Power. To run a steam-jet plant you need steam for ejectors, steam or electricity for cold-water and condenser-water pumps, and cooling water for condenser. More cooling water is needed for steam-jet systems than for those using a chemical refrigerant.

With steam and water available at reasonable cost some advantages of steam-jet units are: only two moving parts—the pumps; easy control; safe, low cost; easy, flexible installation.

Plants having lightly loaded boilers in summer or off-season utility rates for steam can often make steam-jet refrigeration pay off. Chilled water temperature needed should be 35 F or higher for best application.

Uses. Air conditioning, comfort cooling and process work of various types are usual applications for steam-jet systems. Process jobs include cooling of drinking water, beverages, fuel gas, calender rolls and mixers. But before selecting a steam-jet unit for any of these jobs an engineering analysis by machine maker is needed.

Control. Part-load regulation is easily obtained by running booster injector on a start-and-stop basis by automatic controls. Chilled-water temperature is kept to within plus or minus 1 F by usual control setting. Thermostat in chilled-water discharge actuates a relay supplying air to a pneumatically operated valve in booster steam-supply line.

In large units multiple booster ejectors operating in parallel, as in Fig. 3, control capacity. Booster is cut in or out by manually or automatically opening or closing its steam valve.

Where water must be cooled over large temperature ranges, 2-stage evaporators may be used. Cost is only slightly more and there are big savings in steam and water when cooling range is 20 F or more. Two-stage evaporation cuts steam and water needs about 20% when temperature reduction is 20 F.

Pumps. Chilled-water pump removes cool liquid from evaporator. Circulating-water pump is needed for condenser when water-supply pressure isn't high enough. Condensate pump is used when condensers are surface type.

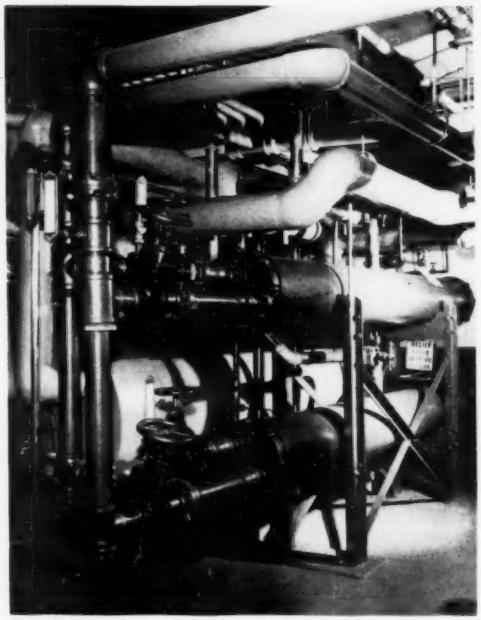
Pumps are conventional centrifugal type, with chilled water and condensate pumps selected to run with a net positive suction head of 4 to 5 ft.

Selection. Steam pressure, condensing-water temperature, chilled-water temperature, steam and water costs all affect size and type of unit picked. Manufacturers of steam-jet units have long experience and are best able to advise which design is best for you.

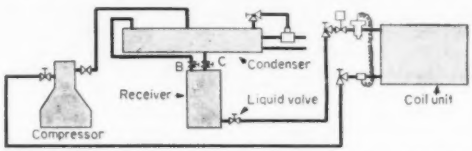
Use highest possible chilled-water temperature and best steam-to-water ratio. Tell manufacturer which type condenser you prefer—barometric or surface. Follow his advice and you're sure to have safe, low-cost refrigeration.

10 HELPFUL TIPS

1 Check system for leaks
2 Pump down system
3 Drain cooling water
4 Remove scale
5 Clean tubes
6 Slack off belts
7 Clean crankcase
8 Renew crankcase oil
9 Clean suction strainer
10 Disconnect starting circuit



TUBE BUNDLES have been removed from chillers and cleaned, valves overhauled and machinery room cleaned up and painted



PUMP LIQUID out of coils by closing liquid valve and running compressor. With all liquid in the receiver, close *B-C*

By **DICK GODFREY**
Refrigeration Engineer
John H Dulaney & Sons

How to Put Your Air-Conditioning

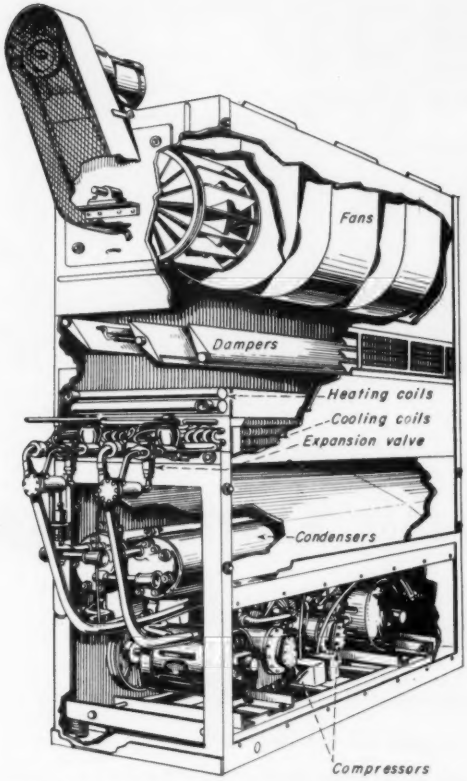
► GIVE YOUR air-conditioning system the attention it needs at the end of this cooling season. Don't merely turn the switch off and forget about your equipment until it's needed next spring. If you did not give your plant attention last fall, don't overlook it now, or you may be sorry next year. Here are the important steps in securing a system properly after the cooling season.

Leaks. First, on all types of refrigeration systems for air conditioning, test the entire system for leaks. Use at least 50 psi, then repair all leaks. With your plant shut down you can take all the time necessary. Then next spring, when you start up the system, you won't have to worry about emergency shutdowns. Your boss will want cooling then, not the information that he will get it when you finish repairing and recharging the system.

Test carefully, paying particular attention to any flared connections. Check joints subject to vibration, also all compressor shaft seals and gaskets. Don't forget to check condenser tubes.

Pumping Down. When you are sure that everything is tight, "pump down" the system. This means locking up all refrigerant in the receiver, or in the condenser if no receiver is installed. Then that valuable gas won't be lost if a leak develops during the winter. This also prevents developing excessive pressure in the low side if a heating coil is near the evaporator. High pressure often blows out the compressor seal.

Close main liquid valve, sketch, then set room thermostat to low enough temperature to cause solenoid valve shown to open. Be sure fan is running during this operation. On many systems the solenoid valve is energized from the load side of the fan starter to prevent mistakes. Start and run compressor until all liquid is boiled out of the evaporator as well as the liquid line.



LOOSEN BELTS, clean motors and tubes, check and oil bearings, clean fan, and check for refrigerant leaks this fall

System to Bed Right

If low-pressure control stops the machine before the suction pressure drops to 2 psig, hold control by hand until this pressure is reached. Pressure will rise after the compressor stops, due to refrigerant boiling out of crankcase oil.

Wait several minutes and trip the low-pressure switch by hand, then pump down to 2 psi again. Repeat as required until pressure stays at 2 psi. That removes all liquid refrigerant from oil in compressor and from traps in system. If 2 psi cannot be reached, then look for leak-back from discharge, usually from compressor head valves. Then close valves *B* and *C* to isolate liquid in receiver until needed next season.

Shell-and-Tube Condenser. Shut off water supply, drain water side, remove heads and inspect tubes. If scale is present, clean the tubes with a wire brush sized properly for a tight fit. Caution: Don't scratch tubes as this often starts erosion that winds up in tube failure.

If wire brush does not remove scale, use a good industrial scale solvent. Most of these are inhibited acids. Observe manufacturer's directions closely and be sure to follow acid cleaning with a neutralizing wash of an alkaline solution. Soda ash is a good source of alkali. Flush the condenser once more with clean water.

Heads may be bolted on again but leave drain plugs out. Disassemble and clean the water-regulating valve completely. Be careful to shut off gas connection to the valve before starting to work on it. Remove handwheel of water shutoff valve, or tag it to avoid its being opened by mistake.

Evaporative Condensers. Drain out water and clean sump pan thoroughly. If galvanizing is damaged, paint the pan with a good metal primer. Disassemble and clean all spray nozzles. Tube bundle in most evaporative condensers is too compact to permit effective manual cleaning.

If tubes are badly scaled, a chemical cleaner may be circulated through the spray system. Neutralize and rinse as outlined for shell-and-tube condensers. Carry out this operation before painting the sump pan. Be sure to drain the circulating pump casing to prevent freezing. Take above steps to prevent accidental opening of water supply valve.

Water Towers. Same steps apply here as for evaporative condensers, except tube cleaning. Redwood-constructed towers need no painting.

Compressor. Slack off belts to reduce stretching. Drain out crankcase oil and clean crankcase, if accessible. Refill with clean oil. Close both suction and discharge service valves. Clean suction strainer, if installed.

Some engineers take the fuses out of the compressor motor circuit to prevent accidental starting with compressor valves closed. I believe in going a step farther and disconnecting a wire in the starting circuit. One lead to the low-pressure cutout is the most common choice. Pull this lead free of the contacts and tape the terminal well. A note placed in the fuse box will be a helpful reminder next spring.

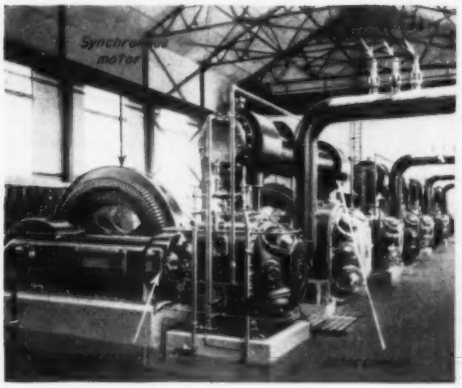
Setting Up for Heating. Some air-conditioning systems use steam for heating. After securing the refrigeration system as outlined here, there are only a few steps in preparing for heating.

Check filters to see that they are clean. Set manual outside air damper to the winter position. Most systems are designed to use less outside air in winter than in summer. Don't block the automatic damper to accomplish this, as it will damage the motor.

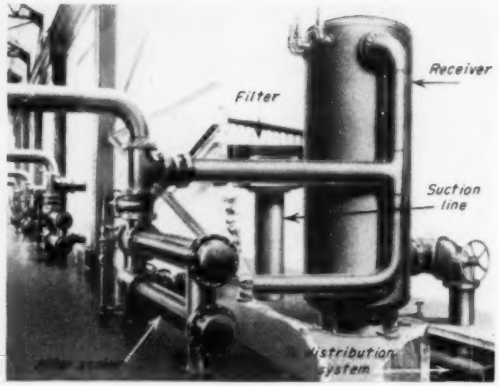
Check the steam-supply and condensate-return lines for tightness.

Set the controls for heating and see that transformer, thermostat and steam valve operate properly.

Follow all these steps religiously and your air-conditioning system will be Johnny-on-the-spot when called on next spring to start off right first time.



RIGHT HOOKUP on this battery of heavy-duty air compressors means difference between high efficiency and frequent repairs



FILTER assures clean intake air while aftercooler and receiver help remove harmful moisture before distributing air

Intake for Air Compressor

Some things you should know...

- *Every 5-degree drop in intake air boosts machine's capacity 1%*
- *Concrete intake crumbles, scoring the cylinder walls*
- *Unfiltered air wears cylinder nine times faster than filtered*
- *Rectangular intake pipe is susceptible to vibration*

By EDMOND C POWERS
Compressed Air and Gas Institute

► INTAKE of air compressor is about the simplest, most direct part of any compressor system. Yet it's as important as any part to performance. Intake controls quality of air supplied at beginning of compressor cycle. That determines energy available, as well as life of air tools and compressor.

Let's consider location and piping:

Location: Intake can be inside the plant, but outside is preferred. Clean, cool air is ideal. Air contaminated with dust, fumes or moisture may reach compressor cylinder, causing lube breakdown and excessive parts wear. The cooler the air the better, because it takes more energy to compress warm air for a given weight. Also, for every 5-deg reduction in intake air temp, there is an actual compressor capacity gain of 1%.

Best outdoor locations for intake are:

1. Locate filter far enough from steam, water, dust, fumes, or other wastes that nearby vents may discharge.

2. Locate intake on shady or cool side of plant. Place it at ground level rather than over a roof where air may be 5-10 deg hotter.

3. Do *not* locate intake openings of reciprocating compressors alongside weak walls, windows, etc. Pulsations immediately surrounding intake may rattle windows, harm weak walls. Locate all filters several feet from any wall to prevent entry of abrasive particles generated by vibrations, etc.

You may not find a clean atmosphere. Then determine what the atmosphere extremes could be and select filter that does the best job. Schedule regular inspection and cleaning. Just installing the filter is not enough.

Piping. Improper piping causes undue turbulence, pressure losses, allows foreign particles to enter compressor cylinders. Keep piping as short as possible. Don't have sharp turns for changed direction. Use material that stands up for your service.

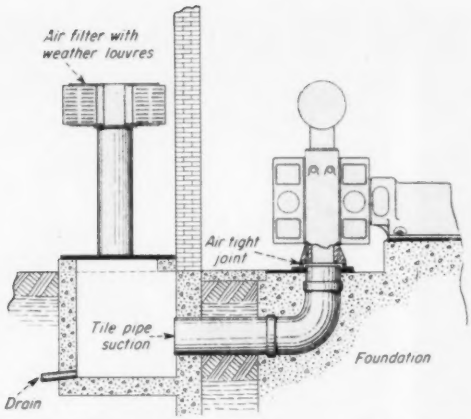
Here are recommendations for good piping performance:

1. Install moisture drain, sketch, p 137. Arrange piping so moisture drains off before it reaches cylinder.

2. Never run intake lines near steam or hot-water lines. Then radiating heat raises intake-air temperature, lowers efficiency.

3. Intake-pipe diameter must equal or be larger than connection on cylinder —never less than 25% of piston area. Increase it one in. in dia for every 10 ft. Low intake-pipe velocity (not exceeding 1200 ft per min) reduces friction, pressure losses, air pulsations.

4. Intake pipe should be as short and



UNDERGROUND intake line has drain, long radius elbows for direction change and other features brought out in article

Affects Efficiency

direct as possible. Use long-radius elbows where bends are needed to insure even flow.

5. Where one intake pipe or duct serves more than one compressor, make cross-section area of main duct at least as large (preferably larger) than combined areas of all individual intake pipes. Avoid sharp corners in branching from the main pipe.

6. Use cast iron, black or galvanized steel, or other material that won't crack and permit entry of foreign materials. Glazed vitrified pipe with cemented joints, all in concrete, is good, sketch above. If you use concrete duct, coat inside with waterproof paint. Concrete crumbles or disintegrates. Then abrasive particles are carried into compressor cylinder. Line wooden duct with metal because it cracks readily, admits foreign particles through cracks.

7. Don't use intake pipes with rectangular cross sections, especially with wood or metal. Flat surfaces are susceptible to vibration and air pulsations.

Often a shutoff valve must be installed in the intake. A gate type is best. A receiver is required between valve and compressor to reduce intake pulsations. Receiver may collect dirt and moisture, so drain it periodically.

Clean intake pipe thoroughly to free it of scale and dirt before compressor is started. When the line runs underground, sketch left, pull a dry swab through it occasionally. That checks against surface-water leakage or condensation.

Air Filter. Right air filter is important part of intake installations. Many compressors have no air filter to speak of Thus, more than 85% of "carbon" found in air-compressor cylinders is nothing more than dirt saturated with oil and baked to a hard mass.

Tests on engines with and without filters reveal that an unprotected engine shows *nine times* as much cylinder wear, four times as much piston wear, ten times as much piston ring wear. Increased wear, reduced efficiency, increased maintenance and outage results from improper filters.

For example, a compressor in a railroad yard without a filter required valve cleaning every two weeks. After a filter was installed, wiping off the valves every six months kept valves working.

There are many types of filters—viscous, perforated plate, dry, centrifugal, etc. Locating intake properly prevents an overworked filter, saves cleaning.

Lye Solution Cleans Steam-Driven Compressor

► To CLEAN steam-driven air compressor of the locomotive type, one manufacturer recommends pumping hot lye water through the air-end every six months . . . more often if air cylinder shows signs of overheating.

Dissolve four ounces of potash to one gallon of hot water in a drum. Disconnect intake pipe and the air discharge connection. Connect hose to intake opening and place in container of hot potash solution. Pipe discharge line from compressor into container.

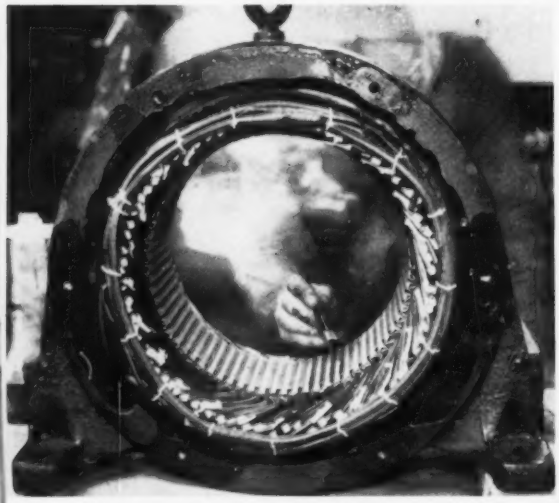
Crack steam valve so compressor runs at 10 to 15 strokes per minute. Circulate solution through compressor for about a half hour. Then circulate enough clean hot water to remove all traces of potash. After reconnecting intake and discharge lines, relubricate the air cylinder. *This is important.*

CAUTION. This method is recommended only for steam-driven air compressors of this type, which normally run at slow speed. Single-stage jobs make about 120 strokes per min. Cross compound machines run at about 131 strokes per min. Cleaning liquid can be pumped in this type of compressor only because machine can be throttled to very slow speed.

To clean oil and carbon from other types of compressors, dismantle and use some grease-dissolving liquid that is nonflammable.

Is it dangerous to clean a steam-drive air compressor this way? Not if solution does not move too fast. If an operator does open the steam valve wide, machine will stall because it is a direct displacement job of power versus output. If the steam valve could be opened instantaneously, the hammer action might knock the air cylinder head off. But this is not likely since the steam valve must be opened by turning.

Prebaking, Insulating-Varnish Dip and Final Baking Complete Winding . . .



1 Paint-masking compound on stator iron between slots and around bolt holes to ease varnish removal after dipping

2 Preheat stator to drive off moisture (about 3 hr at 260 F) before varnish dip. Here stator is lifted after dipping

Rewinding a 3-Phase Induction Motor

Part 2: Dipping and Baking the Stator, Repairing the Rotor, Final Testing

By WALTER J PRISE, *Chief Engineer, The Maintenance Co, Inc.*

► MOTOR REPAIR can hardly be broken into routine steps. True, basic steps are common to all motor rewinds of any one type. These steps were outlined last month and are concluded here for the 3-phase induction motor. Yet the many pitfalls on the rewind path make it important to handle a job in a topnotch repair shop or by well-seasoned rewind men in your own plant.

Here are fundamental "finishing" steps in the rewind job; dipping and baking the stator winding, repairing rotor, final assembling, testing. In reading the captions below photos, remember, no attempt is made to paint a complete picture. This would be impractical mainly because of the many differences in 3-phase induction motors. But you will get an insight into good general rewinding practice today. The article will be helpful whether you farm out your motors or rewind in your repair shop right in the plant.

Stator Varnish. One of the important steps after rewinding stator is dipping in varnish and oven baking. Varnish is part of the electrical insulating covering just as insulation is on single coils. Selection of specific varnish and baking time hinges on class of insulation decided on.

The dipping operation has a technique, too. Keep stator submerged in varnish till bubbling stops. Then rotate stator while in the dip to release any air bubbles trapped in windings.

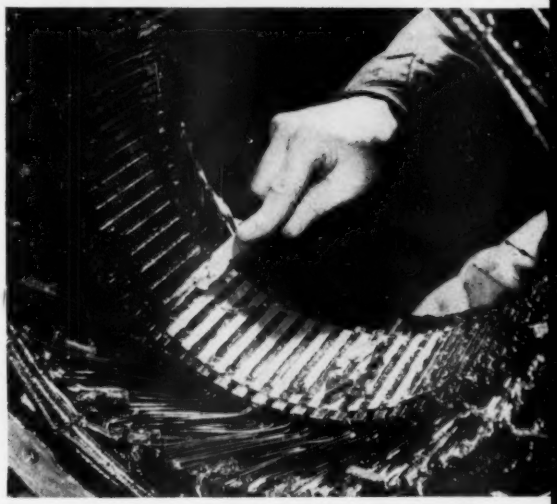
Insulation test measures insulation resistance before motor leaves the shop. Three methods for measuring resistance of electrical insulation with a megohmmeter: (1) *short-time* or spot reading (2) time-resistance or *dielectric absorption* (3) *2-voltage* megohmmeters.

Short-time method means connecting megohmmeter between stator winding and motor frame; then operate instrument a short time. Value indicated is insulation resistance. Ordinarily insulation resistance keeps climbing some time as long as megohmmeter is cranked. Thus, the 60-sec time element has been standardized. This short-time test is generally adequate for stator test after rewinding.

But routine checks on winding condition *after* the rewound motor is in service generally call for the dielectric absorption technique. Here we go a step beyond getting the mere value of insulation resistance. This test indicates if insulation is wet or dirty. To run test, crank megohmmeter 60 sec, taking readings at 30- and 60-sec points. Where the 60:30 sec reading ratio is below 1.25, motor insulation is questionable.

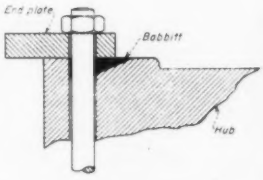
. . . Phase of Job. Masking Compound Eases Varnish Removal Between Slots

3 Place dipped stator in electric oven and bake at an even temperature for 8 hr. Hold 265 F for Class A insulation



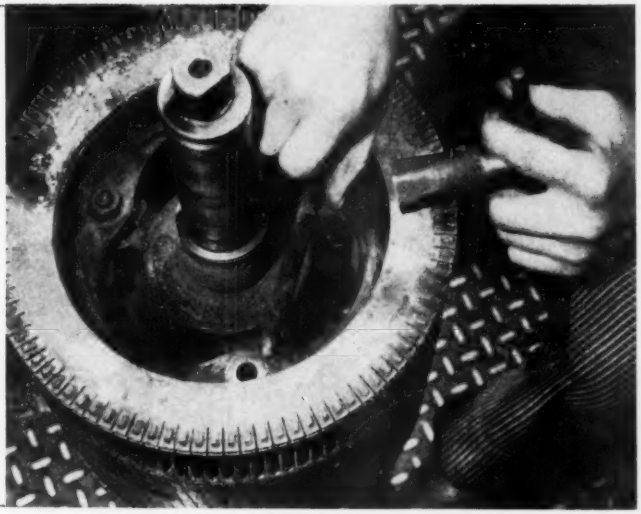
4 Scrape off the masking compound with its varnish cover. This gives proper clearance between the stator and rotor

Rotor Repair Centers About Babbitt Seal in Hub Bolt

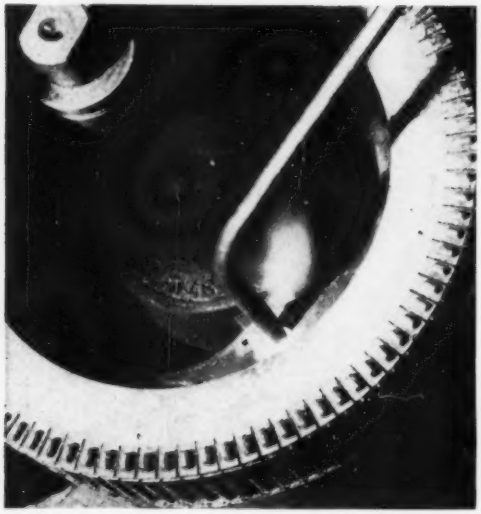


ROTOR SECTION

Here's where babbitt leaked out, burning stator winding insulation. Babbitt left its resting place when rotor temperature zoomed . . . probably because of motor overload



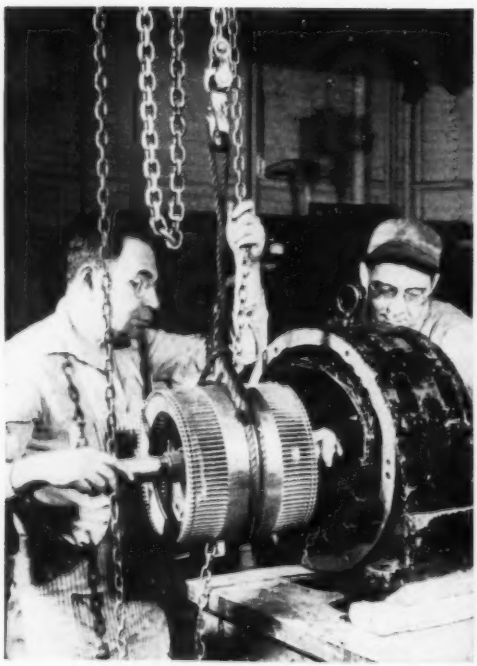
5 Rotor check includes inspection of winding joints and rotor body; squirrel-cage winding is OK here. Only rotor fault was loss of babbitt around rotor belt. Few rotors today use babbitt other than as bearing material *More on next page*



6 Melt out old babbitt with torch. Be careful that heat from torch doesn't loosen the joints in squirrel-cage winding

7 After setting bolt carefully in place, hold rotor level, pour new babbitt in position with ladle and guide-trough

Rotor Repair, a Spin in Balancing Unit, and She's Ready for Assembly



10 Make full use of available tools to cut hand-lifting and moving. Here chain-fall does bull work in assembling

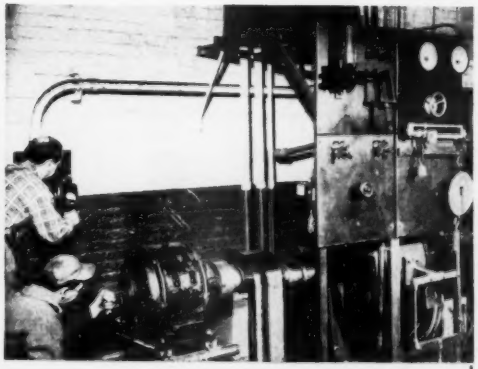
11 Rotate end-bell 180 deg before sliding it on shaft. This prevents shaft banging oil ring. Swing back before bolting

8 Remove excess babbitt. Don't let chips fall into rotor's innards; they may find way to stator when motor starts

9 Here's check for balance. Machine guides you in *how-much* and *where* balancing weight should be added or removed

Insulation Resistance, High-Potential Check Precede Final Load Test

12 Hand megohmmeter tests stator insulation resistance. Use 1 megohm per 1000 v of motor rating as a min



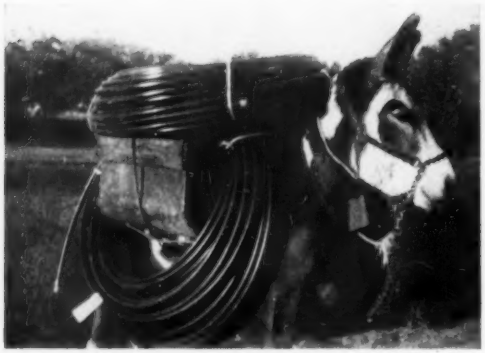
13 Load test includes torque, speed, current. High-voltage test next; twice rated, 1 min (motors under 600 v)

► FINAL TESTING includes insulation resistance and over-potential test plus speed, torque, current check. Insulation resistance measured with a megohmmeter is not in itself proof that insulation is free from mechanical weaknesses or has enough voltage strength. An over-potential test, however, indicates the winding has a certain minimum voltage strength. So follow this plan: first a megohmmeter insulation check, then an over-potential test. For motors in the 600-2200 v class, use 1½ times rated voltage for 1 min.

Dynamometer, above, measures motor torque. It is used widely for testing units of about 100 hp or less. It consists of an electric generator mounted on a "cradle" and supported on trunnions. Unit is mechanically connected to the motor being tested. Pull exerted between armature and field tends to rotate the field itself. This torque is counterbalanced and measured by weights moved along the arm as shown.

Note the clamp-on ammeter for measuring motor input current. An efficiency test can be made using a similarly built clamp-on wattmeter. Motor-slip over the load range is checked with hand tachometer.

PRACTICAL IDEAS ... here's the trading post for your



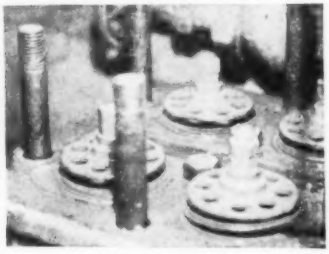
Plastic Piping Doesn't Rot—Is Lighter

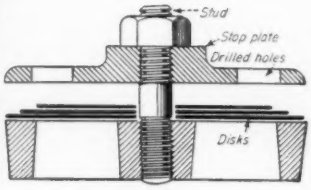
SUSIE THE BURRO, one of man's oldest means of transportation, is shown with what is claimed to be the most modern development in fluid and gas piping.

Owned by the McClelland Supply Co of Phoenix, Susie is used to make deliveries to out-of-way locations. Like all burros, she limits weight she will carry. She also has a "built-in scale" to tell her when she's reached that point. Susie's limit is 135 lb. How do we know? She stages a sitdown strike if another pound is added.

Here she is carrying 1200 ft of ¼-in.-diameter, flexible plastic pipe weighing 124 lb. This weighs only one-eighth as much as metal pipe. According to the manufacturer, Carlon Products Corp of Cleveland, the pipe is guaranteed forever against rot, rust and electrolytic corrosion. Sounds like a money saver.

J GORRIGAN *Phoenix, Ariz.*





Holes Solve Pump's Valve Trouble

WE REPLACED the water-end valves of a duplex steam-driven pump with disk-type valves. As sketch shows, each unit has three 1/16-in.-thick brass disks of progressively smaller diameter. They have a center hole, and slide on brass stud. A brass stop plate is same diameter as the largest disk. Plate is threaded to fit the stud and has a locknut.

We faced off the valve seats and installed the valves. But unless pump ran at any but slowest speeds, there was a terrific water hammer. Supply company's engineer could offer no solution. I reasoned that when disks were raised off seat by incoming water, they squished out water between them and the smooth surface of stop plate. That held disks in the open position and water backflowed when piston reversed.

When disks finally seated, the water hammer took place. We drilled a number of large holes through the stop plate to allow free flow above the disks. Water hammer disappeared and the valves are now satisfactory.

D ALTON *New Westminster, B. C.*

Watch Engineer's Ten Commandments

WITH AUTOMATIC EQUIPMENT taking over, here are "MUSTS" for every person on watch to remember:

(1) Blow down water glass and column when taking over watch and again during watch. (2) Check all boiler-room equipment, such as fan bearings, oil rings, stoker or oil burner mechanisms, pumps etc. (3) Check and clean controls and regulators because automatic and semi-automatic controls won't work unless kept in good shape. (4) Check flue-gas temperatures closely. Stop steam and water leaks promptly. (5) Keep close watch on smoke-stack. (6) Blow down boilers as scheduled to prevent upsetting chemical control. (7) Blow tubes at scheduled times without fail. (8) Test safety valves every day by lifting them with steam. (9) Take hourly readings, regardless of plant's size. (10) Trace out every line and valve so you know where to find it in an emergency.

Follow these in any type plant.

R C CONK *Newark, N. J.*

Fan Thaws Frozen Radiator

UP IN THIS COUNTRY it's not unusual for the radiators of smaller diesel engines to freeze if not drained overnight. Such radiators are built right into the building wall, with outside air blown or drawn in with a fan.

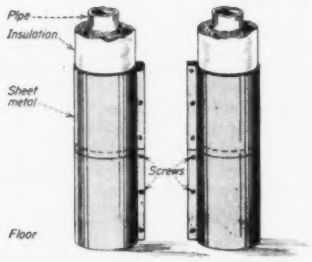
I've had good luck thawing out such radiators by blowing warm room air through them with the fan. If fan pulls in cold air from outside, it's just a case of reversing the fan by swapping positions of any two motor leads in the switch box. If there is a reversing switch, that makes things easier.

If you do reverse the motor, be sure to change leads back to original position soon as radiator is thawed.

DON COCHRANE *Milaca, Minn.*

operating and maintenance short cuts

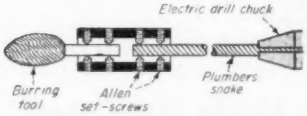
STEVE ELONKA, *Associate Editor*



Protect Pipe Insulation

WHERE PIPE INSULATION is subject to mechanical damage, especially near floors, make simple sheet-metal covers, as in sketch. These covers serve as effective protectors. They are easy to remove when piping has to be repaired and well worth the cost of installing.

THOMAS TRAIL *Catonsville, Md.*



Burring Cutters Save $$$

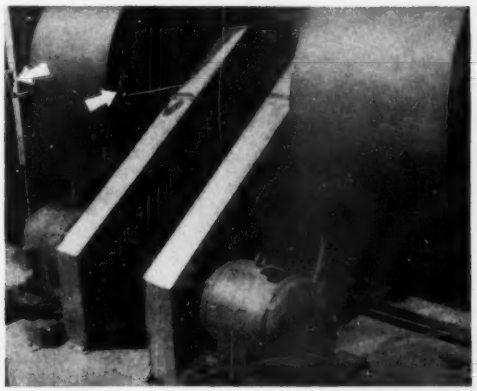
ELECTRICAL CONTRACTOR in our new plant found a half dozen different-sized buried conduits blocked, preventing wires being pulled through.

He came up with a bright idea that saved hundreds of dollars. First he bought burring cutters (rotary files) as in sketch. These he attached to a plumber's snake of the helical-wound spring type and chucked the snake into an electric drill.

On long runs he fed a cutter through from both ends. Starting with a small size, he worked up to a size larger than his wires or cable

Where will a power engineer use this idea? Additional circuits are often needed so wires must be run. Spare conduits are generally provided. But they may be just the ones the electricians did not use because they were plugged with concrete, had nicks or flattened, improper bending. All this reduces the inside diameter of the conduit. The burring tool acts like a long flexible drill, follows curved piping.

F ARDOLINO *Brooklyn, N.Y.*



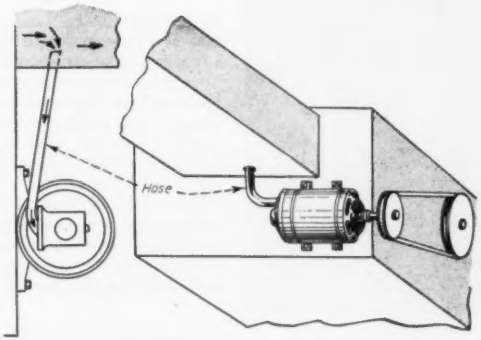
Make Oil Cups Accessible

TOO MANY BEARINGS burn up because oil cups are crammed into tight places where they can't be seen. Since it takes only a few feet of small piping to correct this problem, I run cups out where they can't be missed and are easy to fill.

The two shown here on air-conditioning-system blowers are a good example. I also make sure they are in a light spot so oil level is easily seen. The right time to maintain bearings is *before* they burn up.

Also, note screen on side of V-belts. They not only protect the operating personnel, but allow the greatest amount of air to circulate around the electric motors to keep them cool.

MIKE BRANNIGAN *Kansas City, Mo.*



Cooling Air-Conditioning Motor

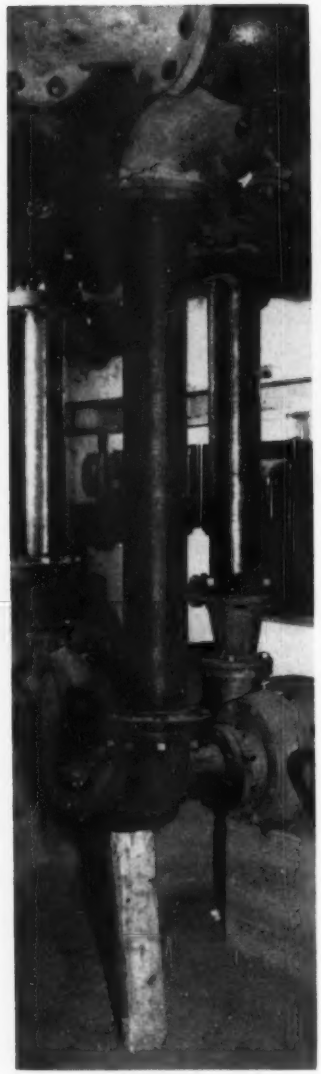
MOTORS on our air-conditioning coolers run 24 hours every day. But these coolers are in the basement machinery room where the temperature stays between 80 and 90 F.

Because the motors ran a little warm, we piped the conditioned air from supply ducts above motors to motor vent openings, as shown. With 40 F air in the air ducts, a short piece of ¾ in. rubber hose now supplies all air to keep motor cool at cooler temperature.

C LOCKRIDGE *Toronto, Canada*

(*Continued on page* 144)

Begins on page 142



Handy Piping Supports

MUCH DAMAGE is done to new equipment during installation. This is often from unsupported heavy piping sections before placing the permanent hangers.

We install air-conditioning systems and take great care to prevent strain from piping weights, especially on centrifugal pumps. Soon as horizontal section of piping is attached to chilled-water pump's eye, we saw a piece of 2x4 to exact length and tap under piping to support heavy weight, photo.

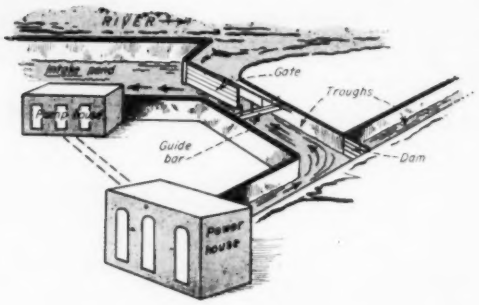
Then after piping is completed, permanent hangers are installed and wooden supports knocked out. I've seen too many expensive pumps develop trouble on the liquid end when this isn't done. It also pays to check old piping periodically for supports that no longer support their load. This happens when overhead-beam supports, which piping is attached to, sag or warp, or when the foundation settles gradually.

MIKE BRANNIGAN *Kansas City, Mo.*

Use Government Literature

UNCLE SAM offers many illustrated, modern technical and instruction manuals covering operation of steam boilers, water tests, calculations, machinery maintenance and installation of equipment as used by Army and Navy maintenance personnel. Most range from 35 to 75c and are well worth the price. Further information from U.S. Govt Printing Office, Washington 25, D. C.

L FITZPATRICK *Jefferson City, Mo.*



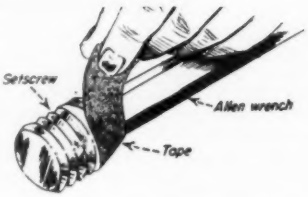
Keep Cooling Water at Steady Temperature

MAINTAINING intake water for our turbine and generators at a regular temperature in zero weather was a problem. To regulate amount of water flow, we had to either take boards out or put them in (at outlet marked *Dam* on sketch). This had to be done at least four times a shift to keep temperatures within operating range.

To remedy, we had our carpenters make a permanent dam. That diverts all water into intake pond trough. At end of this trough, a swing gate is installed along with a guide bar on which the gate handle rests. This keeps gate in desired position. Pegs on guide bar are placed six inches apart, giving six different positions for regulating gate.

In zero weather, we keep gate at mid-position. Thus, half of discharge water goes into the pond, while other half goes into river channel. In cold weather, more water is let into pond. In summer, swing gate is closed, letting all water go out with river. Now, depending on the weather, no attention is required for as long as a week or two.

JOHN FARINA *Princeton, Can.*

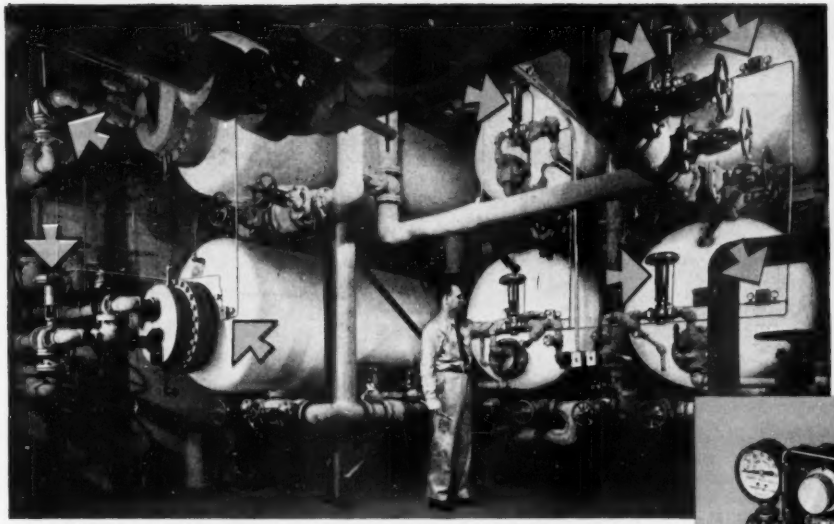


Holding Setscrew

SOMETIMES a small hollow setscrew must be inserted in a tight spot. To keep the setscrew attached to the wrench until the threads have engaged, wrap a layer or two of scotch or friction tape around screw and wrench, as in sketch.

THOMAS TRAIL *Catonsville, Md.*

(*Continued on page* 146)



Chief Engineer Edward MacDonald states "Performance of Powers Accritem Temperature Regulators has been highly satisfactory on the 6 water heaters shown above as well as on booster heater for dishwasher and for controlling cooling of condensate before discharge to sewer."

WATER HEATERS AT LEVER HOUSE New York City

Architects: Skidmore, Owings & Merrill

Consulting Engineers: Jaros, Baum & Bolles

Contractor: Gillman-Rous-Pesce Corp.

One of Lever Brothers Co. Famous Soaps

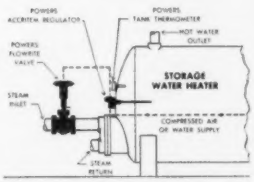
Powers ACCRITEM Regulator
Compressed Air or Water Operated

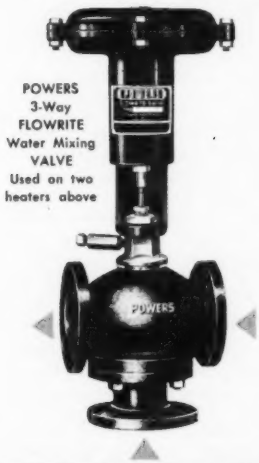
Unsurpassed for reliability and power to operate large or small diaphragm valves controlling Water Heaters, Heat Exchangers, Jacket Water Cooling for Diesel Engines or Air Compressors and many Industrial Processes.

POWERS WATER TEMPERATURE CONTROL

ACCRITEM Regulators were selected for LEVER BROTHERS beautiful modern building on Park Avenue in New York City. The air conditioning system here is also Powers controlled.

Water heaters in more and more prominent buildings are being equipped with Powers Accritem Regulators because of their —





POWERS 3-Way FLOWRITE Water Mixing VALVE Used on two heaters above

Important Features that Give Better Control and Lower Maintenance

- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures years of reliable service.
- ***Temperature Ranges*** 50-250° F. and 150-350° F.
- ***Easy to Install.*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size***—regulator head is only 2⅞" x 3⅜", sensitive bulb is 12" long with ½" I. P. S. connection.

Bulletin 316 gives full details

Call Powers for aid with your problems of temperature control. Our more than 60 years of experience may be helpful to you. Whether you want a simple self-operated regulator or thermostatic water mixing valve or a pneumatic control system with recording controllers. . . contact Powers.

POWERS Single Seat FLOWRITE VALVE Used on 4 heaters above

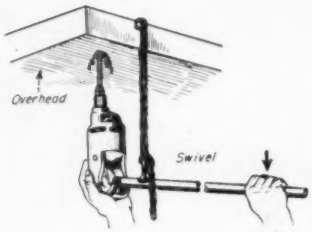
THE POWERS REGULATOR COMPANY

Skokie, Ill. • Offices in Over 50 Cities, See your phone book • Established 1891

(a91)

More PRACTICAL IDEAS

Begins on page 142



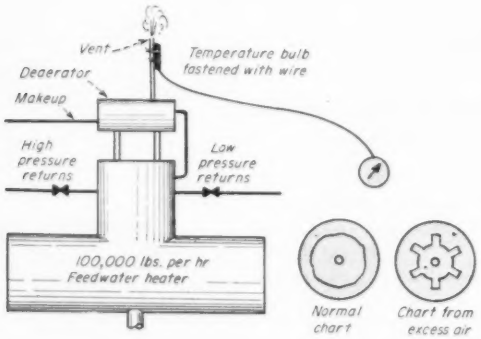
'Old Man' Saves Elbow Grease

PUSHING AN ELECTRIC DRILL takes plenty of beef, depending on hole size and material being drilled. I built the handy 'old man' shown to make life easier and save time around our plant.

A 31-in. piece of ¾-in. pipe is welded to a hook that fits over end of drill. A swivel snap is welded about 4-in. from the hook end for a fulcrum. A small hook made of strap iron is attached to chain's end as shown. This hook is anchored to a pipe, bench, hanger or anything near the hole to be drilled. Other end of chain is snapped into swivel on pipe.

It's just a case of anchoring the chain, snapping right link into swivel snap-hook and pulling up on pipe while drill is shoved through metal. Our maintenance mechanic Dick Perse is shown in photo using this rig on a horizontal job. I've drilled a lot of holes in all kinds of places, but all of us have agreed that this is the handiest 'old man' we've had around. It's in constant use here.

C JEFFERSON *Shiprock, N.M.*



Temperature Recorder Finds Air Leak

WE HAVE A DEAERATING feed-water heater for our boilers. Our condensate from heating lines and high-pressure trap-returns are piped directly into heater. To make sure all traces of oxygen are eliminated, we add sodium sulphite to water before it enters boilers. We try to maintain 20 ppm sulphite in boiler water.

One day our log sheet showed that we were getting only 5 ppm with proportioning pump running full stroke. We checked our chemicals but found them up to standard. Then we checked outlet on deaerator vent. It appeared to have a lot of air coming out with the steam vapor. We knew it was either from the heating line returns or from the high-pressure steam-trap returns.

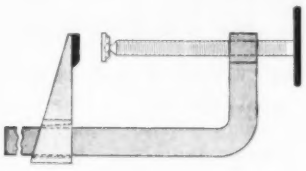
We closed high-pressure trap return-line to heater first. That seemed to stop excess air coming from vent of deaerator. With hundreds of traps throughout the plant tied in on rubber tire presses (where both steam and air are used), it looked like a big job.

We put a temperature recorder bulb on deaerator vent and watched chart on recorder. To our surprise, the pen on chart dipped about 50 F every 15 minutes, then went up to normal temperature for 20 minutes.

We traced airing operations on rubber tires from time on chart. We found that on this one operation they used air for inflation and then finished curing with steam. Somehow, while press repairs were made over week-end, maintenance men had connected both air and steam bleed-off lines into high-pressure trap return line by mistake.

So keeping log sheets in power plant paid off this time. If this trouble was not detected with temperature recorder, it could have caused plenty of damage to boilers and steam lines.

A PULLEKINS *Akron, Ohio*



Handy 'C' Clamp

"C" CLAMP SHOWN is very simple to make and has been found very useful by our mechanics. Horizontal holding piece is easy to slip off and use on any length of vertical stock. It stays in any set position without slipping. That increases available clamping distance greatly.

Usual threaded clamping piece is shown, which most of our men have taken out of old clamps and used on this. These clamps are on the market.

G E BOYHAN *New York, N.Y.*

Small Bags Are Handy

WATER-TREATMENT CHEMICALS can be purchased in 100-lb bags at fraction of cent increase over larger 300- to 500-lb containers. Bagged unit makes easier storage, handling, and eliminates accident possibility in moving larger container. Often bagged units actually save money because of "dead freight weight cost" of larger unit containers.

L FITZPATRICK *Jefferson City, Mo.*

steam trap trial shows how to increase production

Flat-work ironers in Pennsylvania laundry heat up in 15 min. with Yarway traps instead of previous 1½ hours.
West Coast Rubber molding plant cut heating cycle on presses from 15 minutes to 8 minutes by using Yarway traps.
Kettles in New England hospital kitchen reach cooking temperature in 12 minutes with Yarways instead of previous 25 minutes.
Southern textile mill gets satisfactory slasher production for first time due to faster heating-up with Yarway traps.

These 4 plants—each in a different industry—have something in common. Each installed a Yarway Impulse Steam Trap on a trial basis—and after witnessing the production-boosting results, they standardized on Yarway traps.

Experiences like these are found in hundreds of plants because Yarways are *designed* to get equipment *hot in a hurry,* and therefore into production fast.

Coupled with other Yarway Impulse Steam Trap advantages like small size, easy installation, stainless steel construction, easy maintenance and low cost—it explains why more than 800,000 Yarways have already been installed.

YARWAY

the steam trap designed with more production in mind

YARNALL-WARING COMPANY ○ **100 MERMAID AVENUE, PHILADELPHIA 18, PA.**

PLANT PROBLEMS . . . *put your know-how to work*

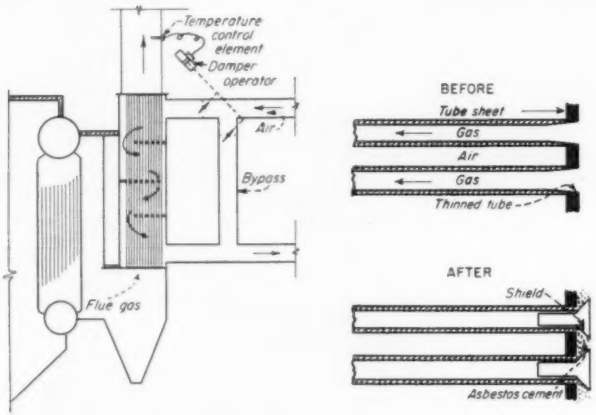
How Can We Keep Air Heaters Clean?

HERE ARE THE FACTS: Our large steam plant has three types of air heaters—plate, tubular and regenerative. In recent months they've given us trouble. Dirt accumulates on gas sides and there has also been some corrosion of heat-transfer surfaces.

Two of our boilers are stoker fired; the other two have pulverizers. Stoker-fired units show the most corrosion in the air heaters. Gas-side accumulations in plate and tubular heaters are hard; steam lance won't remove them at all.

What I'd like to know is how other *Power* readers control plugging and corrosion troubles in air heaters. Will soot blowers clean gas side? Are gas and air recirculation effective? Will they stop hard deposits?—*JL, June Power*

Here Are the Answers



SULFUR TRIOXIDE may form in flue gas when temperature is too low. In the presence of water vapor, sulfur trioxide changes to sulfuric acid and corrodes air heater parts.

Keep plate or tube temperature above flue-gas dewpoint to prevent condensation and acid formation. Bypass damper, arranged as in sketch, is one way to keep flue-gas temperature at desired level in this plant.

G F CONNELL *Detroit, Mich.*

WE BLOW tubes in our tubular-type air heaters every eight hours. Once a year we turbine the tubes. Corrosion and dust accumulations have never bothered us. Watch out for gas pockets in heater. In them, is where gas temperature falls below dewpoint.

J P DEMAS, SR. *Roselle Park, N. J.*

OUR BOILERS are combination oil- and pulverized-coal fired. In 14 years we've never had any trouble with gas-side scale in air heaters. This, we believe, proves that our soot blowers do a good job.

About five years ago, gas side of first-pass tubes showed much wear and thinning at ends. We renewed the tubes, and boiler manufacturer recommended putting in flared protective sleeves at tube ends as sketch shows. So far we haven't had any wear at tube ends.

We like these sleeves because if they wear it will be easy to replace them in a hurry. Replacement cost is low. Space around sleeves is packed with asbestos cement to hold sleeves in place and to protect them from hot gas.

ART CANNON *Laurence Harbor, N. J.*

AT LIGHT LOAD air-heater corrosion is worst because tube temperature is lower. Worst effects are at points where incoming cold air first strikes the tubes.

With high-sulfur fuels you can reduce corrosion by recirculating air or preheating it with steam coils. Keep temperature of heat-transfer surface above flue-gas dewpoint at all times while boiler runs.

Recirculation or preheating reduces gas-side deposits. Some deposits are soluble in warm water and easily washed off. Be sure to neutralize heating surfaces with a mild alkaline solution after warm-water wash.

Poor air control may cause more corrosion with stoker-fired boilers than with pulverizers. Check excess air in stoker units. Too much reduces air-heater temperature.

A RODRIGUEZ ULLOA *Mexico City, Mex.*

LOW VELOCITY at gas inlet and outlet connections may cause tube or plate plugging. Check with manufacturer to see if heater was put in right.

Pulverized fuels produce large amounts of ash. Ash from some coals is more abrasive than from others. Abrasive ash may polish air-heater surfaces while soft ash can pack and build up in passages.

Straight-through gas flow causes least build-up of the ash. Too much moisture in flue gas increases heater maintenance. This moisture may come from the fuel, soot blower or economizer leaks, water used in ashpits, or from steam lances for furnace slag removal.

Pick your cleaning method for the worst condition when you burn more than one fuel in a boiler. Special soot blowers may give good cleaning.

Water cleaning is good for regenerative heaters. Use warm water in a ⅛-in.-dia lance. Saturate deposit to soften it and flush away with a second wash. Be sure there are pockets or hoppers under preheater to collect wash water. These are needed to prevent water from reaching places where it may do damage.

Alkaline pretreatment is sometimes used with wash water. Sprinkle soda ash in working area to neutralize any acid that might come from heater.

L W FITZPATRICK *Jefferson City, Mo.*

AIR HEATERS improve boiler efficiency and allow unit to generate more steam. So keeping heaters in good repair is important in all power plants.

help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

Many air heaters have a certain amount of corrosion and plugging. Low gas temperatures lead to corrosion. Plugging can occur at high or low gas temperatures.

Steam or air soot blowers are not desirable when exit temperature of gas is close to dewpoint. Usual deposits are difficult to remove with steam or air jet. Washing with warm water, scraping or wire-brushing may give better results, depending on type of deposit.

Plate and tubular heaters may be cleaned with soot blowers if flue-gas temperature is in the normal range. Blowers are at hot end of heater and discharge in gas-flow direction. Single element for each tube or lane works well. Or several elements can be mounted on a carriage that is moved across heater.

JL would be smart to find the dewpoint of his flue gas so he can run heater at a higher temperature. This is a good way to control corrosion.

A J BREUGELMANS *New York, N.Y.*

BRITISH PRACTICE may not be the same as American in all respects, but *JL* may get some ideas from what we do.

First, corrosion and deposits seem quite common so *JL* can't expect to stop them entirely. What he must aim for is to keep them in control so they won't damage boiler or heater.

Plate-heater plugging and corrosion have been stopped by increasing the space between plates and using special steels for construction. Air recirculation to keep temperature of inlet air at 130 F, or higher, also cuts trouble.

Some new installations in England use a small air heater in series with the main heater. Air flows through small heater last and if there are any gas-side ash accumulations they occur in it. Small unit is easy to shut down and clean. Main heater is protected from heavy ash deposits.

Tubular heaters built in two sections work well on stoker-fired boilers. Sectional arrangement allows use of shorter tubes. This means that cleaning is easier with permanent soot blowers built into the heater.

T H CARR *Yorkshire, Eng.*

THREE REASONS for keeping plate or tubular air heaters clean are:

1. Flue dust acts as heat insulator on tubes or plates. It reduces air heater efficiency and allows flue gas to enter

(*Continued on page* 206)

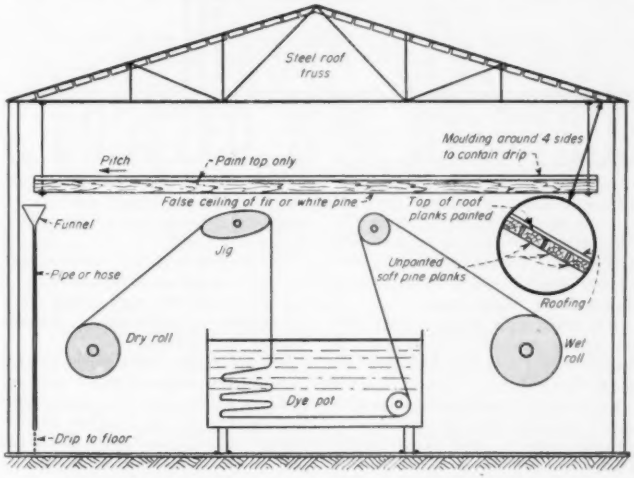
How Can We Stop Ceiling Condensation?

HERE ARE THE FACTS: A dye room in our plant has a steel roof supported by steel beams. Dyeing machines in room give off much heat and steam. In winter, condensation on underside of ceiling is so excessive that dripping water interferes with production.

Sprinkler heads and type of building construction prevent us putting up a false ceiling. We've thought of insulating the ceiling, but since room is large we'd like to be sure before going ahead with a job of this kind.

Also, room air contains a considerable amount of acid and alkali fumes. Will these injure insulation? Or is a fan that removes air from room better than insulation? Where should we locate fan? What's best material for fan wheel and housing?—*WM, June Power*

Here Are the Answers



WOODEN ROOF is best for a dye house. Insulating properties of wood keep condensation low. Moisture that reaches wood is absorbed during working shift. Wood dries out while plant is off line.

If dyeing operations can't be transferred to a wooden-roof building, suspend soft wood panels above dyeing machines. Leave wood unpainted.

Vertical roof fan also helps clear up air. Roof fan, vertically mounted, is better than a wall fan because wind doesn't affect it. Sketch shows setup.

A M PALMER *Brooklyn, N. Y.*

USE ADHESIVE to hold insulation on under side of roof. Spray a moistureproof layer on exposed parts of insulation.

E W MCKNIGHT *Memphis, Tenn.*

DEHUMIDIFIERS might do the trick for *WM*. There are many designs available for different types of jobs. Manufacturers will be glad to advise him on best unit for his dye room.

JOHN PHILLIPS *Dayton, O.*

VENTILATE, INSULATE. If you can't do both, at least insulate. Local ventilation with exhaust hoods over equipment is best. A rough rule I use for finding fan capacity in cubic feet per minute is: divide room volume in cu ft by three.

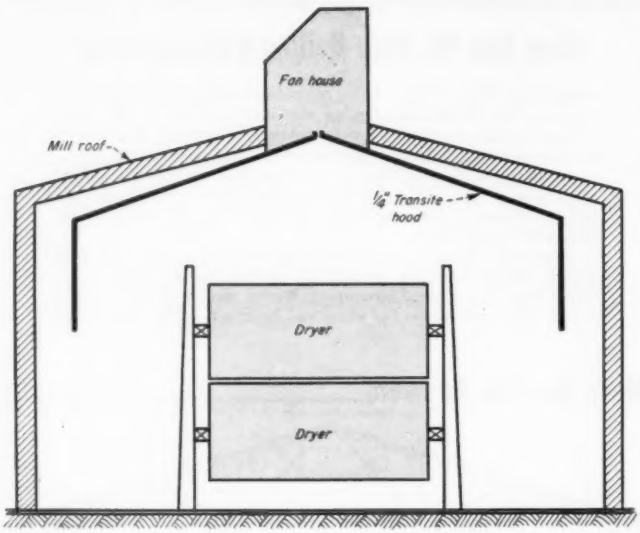
Use an asphalt or plastic-base insulation that can be sprayed on steel ceiling. This does a good job.

G F CONNELL *Detroit, Mich.*

(*Continued on page* 150)

More PLANT PROBLEMS

Begins on page 148



PAPER-MILL engineers often run into the same problem. A paper machine producing 50 tons of paper per day evaporates as much as 80 tons of water. To stop sweating, machine is enclosed with a ¼-in.-thick Transite hood fitted with exhaust ducts running to roof fans. Sketch shows typical setup.

WM might try a similar canopy over his dyeing machine. It eliminates a complete roof job and effectively reduces the sweating.

Of course, a well-insulated roof is also a big help. Built-up rotproof construction with a good vapor barrier should be satisfactory. Don't install a roof fan without first insulating roof. Fan increases drafts, heating load, and may cause more sweating of the roof.

Protect fan and housing against corrosive dye-house vapors. A mastic brushed or sprayed on fan or a rubber coating works well.

Just heating room air cuts sweating, but there's a definite limit on amount of heat you can put into room without making workers uncomfortable. Also, air heating may be expensive.

In large plants where much air and vapor must be removed from room, two fans are needed, one for supply and one for exhaust. Incoming air can be heated in a vapor heat exchanger through which the exhaust fan draws or discharges air.

G E Boyhan *Ticonderoga, N. Y.*

CEILING SWEATS because its temperature is below dewpoint of room air. *WM* can stop this by keeping ceiling temperature higher.

Two solutions are: (1) Build up a membrane-type roof above the present one so ceiling temperature stays higher than room-air dewpoint. (2) Blanket ceiling with warm air from unit heaters to keep ceiling temperature high enough.

Unit-heater manufacturers will be very glad to advise *WM* on the best way to do this job in his plant.

H A Kanniainen *St. Albans, W. Va.*

VAPOR BARRIER directly on steel roof won't work because expansion and contraction may cause rupture. Apply insulation to top of steel roof, covering this with built-up roofing. Seal roof joints with felt or paper vapor barrier before insulating. Where roof has a slope greater than 3 in. per foot, board or block insulation must be anchored.

Be sure to get a written guarantee from roofer before going ahead with the work. It's worth paying a little more to get a good job.

R R Schieck *Niagara Falls, Can.*

STEAM HEATERS, finned-coil type, licked this problem in our packing plant. Heaters are mounted on ceiling with fans behind them. One heater, over each spot where we had drips, was enough. Drips stopped and we don't need regular heating equipment for the room.

H Holcombe *Los Alamos, N. M.*

HEAT CEILING in winter with ½-in. OD copper tubing spaced on 9-in. centers. Use exhaust steam in tubing, if possible. We prefer heating coils to fans and insulation because coils do a better job with less maintenance.

N S Thyagarajan *Alwaye, India*

SPRAY INSULATION on roof under side. Vent vat-type dyeing machines to outside. Vent stacks reduce high humidity and give better working conditions. If vats cannot be covered, ventilate space with a fan of suitable capacity.

J P Demas, Sr. *Roselle Park, N. J.*

ROOF FANS of suitable materials will pull moisture-laden air from room. Use several small fans in preference to one large one. Fit fans with automatic shutters so they open when fan starts, close when it stops. Then there won't be any chance of drafts in plant.

L W Fitzpatrick *Jefferson City, Mo.*

BUILD HOOD over dyeing machines and use fan to exhaust moisture-laden air. See Power's "Men of Action" June, pp 107-111, for hood photos.

B D Riley *Brunswick, Ga.*

What Makes Diesel Shift Its Loads?

Four more answers to CM's question in the May 1952 issue of Power

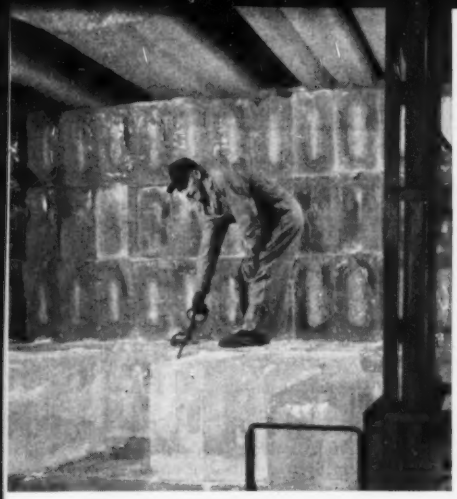
COMMON TROUBLE with engines running at speeds slightly different from synchronous, *CM* shouldn't worry about it because it has been cured in other plants.

CM's governor should have a speed droop of about 3 to 5% so actual speed control is by the greater source of energy. With a slight increase of engine speed and a change in governor speed droop, he should have no more trouble.

If oscillation periods don't decrease after the suggested changes *CM* should have engine manufacturer check to see if unit's WR^2 is high enough.

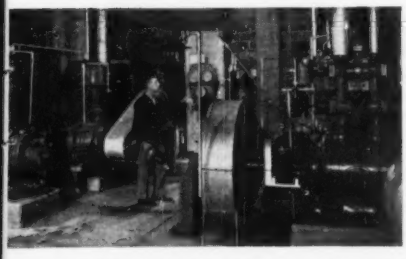
Frank A Butler *Dallas, Texas.*

(*Continued on page* 152)



450 TONS OF ICE can be safely stored in this room. All of it is needed for concessions at Hershey Park and for domestic consumption. The supply is always dependable, thanks to Suniso.

THE HERSHEY BEARS AVERT A SCORE. The ice for this sports arena has been supplied with the help of a Suniso Refrigeration Oil for about six years. With a previous oil, compressor breakdowns were a constant threat to the sports program.



TEMPERATURES FROM −50F to +50F are supplied by these Frick ammonia compressors. They circulate brine through coils in the ice plant and under the arena floor, and ammonia through coils in the cooling and quick-freezing rooms. One grade of Suniso lubricates all of these compressors. Overall efficiency has been 15 percent better ever since its adoption.

75 TONS OF PEACHES AND APPLES are stored at 31F to 35F. Nearby are cold rooms protecting potatoes, cheese and raisins at 38F to 40F, powdered milk for chocolate at 40F; a quick-freeze held at −40F to −50F; frozen food storage at −6F to −8F. These rooms are all serviced by the same central system which handles the arena and ice plant.

COMPRESSOR EFFICIENCY BOOSTED 15% BY SUNISO

The refrigeration compressors which service the Hershey Sports Arena, home of the Hershey Bears, are part of a central system which also takes care of an ice plant, frozen food lockers and cold storage rooms. About six years ago, the compressors were losing efficiency because of an inadequate refrigeration oil. It formed excessive lacquer and carbon deposits, which clogged the lines and made frequent overhauls necessary.

To solve the problem, management called in a Sun representative, and on his advice switched to a Suniso Refrigeration Oil. Suniso's natural detergency immediately began attacking the deposits throughout the system, carrying the sludge to traps and filters. Soon the system was entirely clean. Since then—over six years ago—the compressors have run at an overall added efficiency of 15 percent, and have always been equal to the heavy requirements made of them.

SUN OIL COMPANY, Dept. P-9, Philadelphia 3, Pa.

If faulty lubrication is possibly costing you compressor efficiency, use this coupon to get: ☐ the services of a Sun representative, ☐ a free copy of the technical bulletin "Lubrication of Refrigeration and Air Conditioning Equipment."

Name_____

Title_____

Company_____

Street_____

City_____ Zone_____ State_____

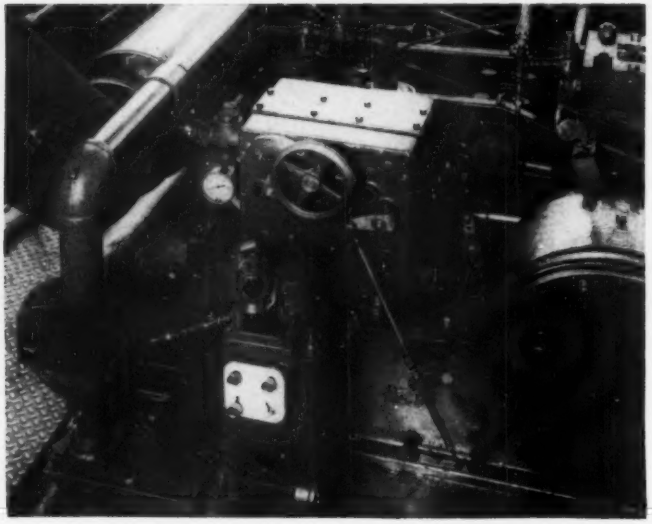
SUNISO REFRIGERATION OILS

SUN OIL COMPANY, PHILADELPHIA 3, PA. • SUN OIL COMPANY, LTD., TORONTO & MONTREAL

SUNOCO®

More PLANT PROBLEMS

Begins on page 148



A CLEAN GOVERNOR with well-maintained linkages, like those in photo, gives best results. *CM* should check his engine to see that governor is in top-notch condition and holds engine speed to within right limits. Then he'll have less load shifting.

K J Dawson *New York, N.Y.*

TORQUE IMPULSES of engine driving 700-kw unit may have a frequency close to a natural frequency of the system consisting of the three generators and the line. System may oscillate and power pulsations may occur between the various components of the system. Torque impulses need expert analysis because they are usually too involved for the average plant operator who doesn't run into them often.

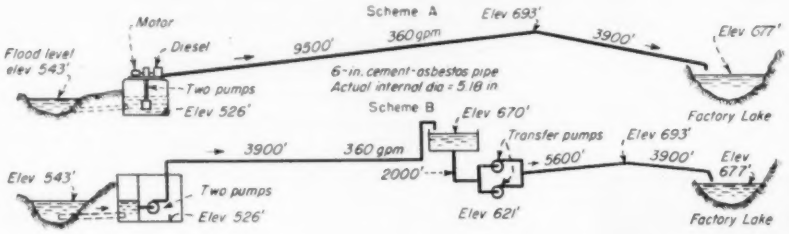
Check to see engine has proper speed and generator rotor WR^2 needed for good operation in the system. Manufacturer normally assumes responsibility for successful parallel operation of his engine. Call him in for advice on best way to stop the load shifting in the plant. He'll be glad to help.

L J Weidner, Jr
S. Pasadena, Calif.

LUBRICATE governor joints, bearings and rotating mechanism to reduce sluggishness. See governor manufacturer before choosing an oil. He may suggest an oil other than that in engine crankcase to use for the governor.

C A Wilkes *Oaklyn, N. J.*

YOUR NEW PROBLEMS FOR SEPTEMBER



1 Which Is Best Pumping Scheme?

We need more water in our plant. The two schemes in sketch have been offered to us.

We like Scheme *A* using two turbine pumps run in parallel. Drive is by motor or diesel. Scheme *B* has four pumps in two stages. In each scheme two pumps run during day when we need 360 gpm. At night only one pump runs to supply about 180 gpm.

Which scheme is best? What are pipe losses during maximum flow and when only one pump runs? Are air valves needed to stop siphoning action?—*JC*

2 What's Best Way To Clean Bus Bars?

Copper bus in our plant gives us plenty of maintenance trouble. Our bars vary from ¼x1 to ½x2½ in. System is 3 ph with a total bus length of 200 ft for our overhead crane. Other runs are shorter.

Bus bars are now cleaned two to three times a week with a rag wheel and jeweler's rouge. We've tried emery cloth but it didn't work as well as rouge.

Is there any other way of cleaning these and other plant bus bars? Some atmospheres in our plant are oily, others acid. We'd like to go as long as possible between cleanings. Any help *Power* readers can give us will be appreciated.—*AS*

Will you help readers who sent us problems? Extra pay for photo or sketches

FROM OUR FILE OF HEAT INSULATION JOBS

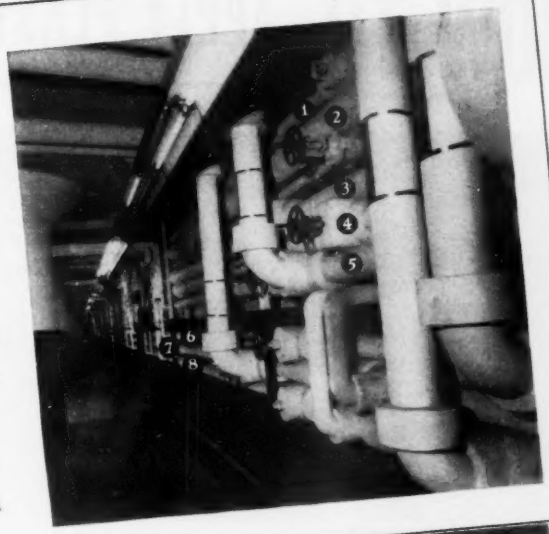
CONTRACT # 51995

COMPANY:
Western Electric Company
Baltimore, Maryland

INSTALLATION:
Pipe lines carrying steam, air, hot and cold water

KEY TO PIPE LINES:

1. 3" 50-lb. steam line Std. Thick 85% Magnesia
2. 6" 300-lb. steam line Dbl. Std. 85% Magnesia
3. 4" 40° water return Light-Duty Cork Covering
4. 4" 40° water supply Light-Duty Cork Covering
5. 4" 200° water return Std. Thick 85% Magnesia
6. 4" 200° water supply Std. Thick 85% Magnesia
7. 4" 200° water return Std. Thick 85% Magnesia
8. 4" 200° water supply Std. Thick 85% Magnesia



A neat job like this is no accident

Complete Insulation Contract Service

A satisfactory insulation contract is more than a bid on a set of specifications. There are other factors that cannot be written into a proposal but which can largely determine whether or not the agreement will be entirely satisfactory. They include:

1. Financial responsibility — resources to complete the contract despite any unforeseen events.
2. Integrity—a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience plus technical and research staff to complete the work in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency—ability to handle accurately things like accounting, tax provisions, insurance, and workmen's compensation.

You get all these with an Armstrong Contract

The neat finished appearance of this maze of nested fittings and close-together pipe runs didn't just happen. It resulted from sound engineering and top-grade workmanship. First, piping was laid out carefully with lines spaced to allow for full insulation thickness at all points. Second, the insulation was applied and finished in a workmanlike manner by the mechanics of Armstrong's contracting organization.

This intricate piping supplies steam, air, hot and cold water to machines that automatically apply rubber insulation to telephone wires. As shown in the key above, steam and hot water lines were insulated with 85% Magnesia. Armstrong's Light-Duty Cork Covering was used on cold water lines. These quality materials, correctly specified and installed according to approved methods, will give years of efficient trouble-free service.

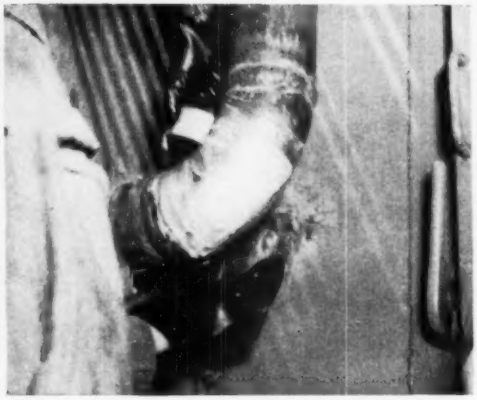
The next time you're in the market for heat insulation work, get in touch with Armstrong Cork Company. We can help you engineer the job, as well as supply good insulating materials and experienced workmen to apply them. Just contact your near-by Armstrong Office or write today to Armstrong Cork Company, 7009 Maple Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures up to 2800° F.

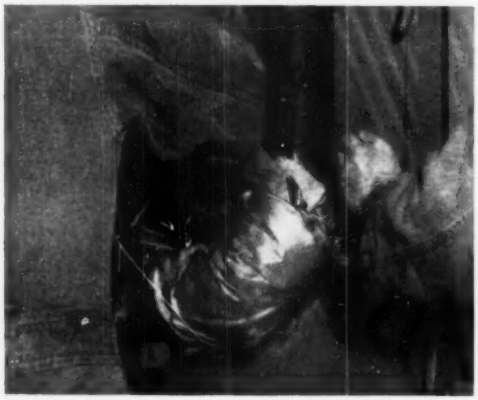
HOW TO APPLY PLASTIC PIPE PATCHES

COAT fibrous-glass tape with plastic resin by allowing tape to pass through resin in can supplied by manufacturer. Stand with reels makes this job easy and fast. Follow instructions



APPLY resin to inside of void cover. Tape with 1½-in.-wide coated fibrous-glass tape. Have pipe clean and dry before covering. Tape is wound on cover much like an arm bandage

USE remaining resin on mat wrapped over taped patch. Mat gives mass and adds strength to patch. It also induces a faster chemical reaction during curing. Patch curing temp is 300 F



BIND finished patch with kraft wrapping paper to hold resin in place while chemical reaction takes place. Heat is given off while patch sets. Pipe may be hot or cold during patching

► First aid for battle-damaged pipes developed by Navy uses well-known bandaging methods for fast, tight patches. Damage Control Training Center at Philadelphia, under direction of Commander T M Peterson, USN, made studies and tests for patch application.

Within a few months a similar patch will be ready for power and industrial plants. Present patch handles water pressures to 500 psi continuously, is applied without special preparation of pipe. Hardness approaches that of steel.

Flow from broken or leaky pipes, flanges, elbows and connections of various sizes is stopped by patch. Odd shapes and jagged edges in ruptured lines offer no problem. You can join completely severed ends as well as "sunflower" type bursts. Where application conditions are ideal, pressures higher than 500 psi are allowable.

Have pipe surface dry before starting patch. Trained crew puts patch on elbow or straight pipe in 7 min, on flange in about 14 min. Depending on conditions, pressure is back on line in 35 to 55 min after start of job.

Main uses in industrial plants are exterior protection of exposed pipes made of fragile materials and in preventive maintenance. Steel, iron, lead, porcelain and aluminum are a few materials patch adheres to.

Products were developed for this patch by Cordo Chemical Corp, Norwalk, Conn. Reinforcing mat is Fiberglas made by Owens-Corning Fiberglas Corp, New York, N. Y.

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers

Those Monday Morning Blues

STEVE SMITH'S STORY, "All Fired Up Over Something" (p 148, May POWER), reminds me of a good one. A plant I worked in started with one boiler and one direct-connected engine. Later, they added two more boilers and two direct-connected steam-driven air compressors. Result was three separate steam lines (with 2-in. equalizers tying them together) and three separate exhaust lines. Some mess!

Common steam and exhaust lines were clearly needed, but it took a bad dose of water carryover that wrecked a cast-iron throttle valve on an air compressor and kinked the steam piston rod to get it rolling. During a weekend shutdown we hooked up the exhaust main, finishing the job about 2am Monday. Then we bedded down on the engine-room floor to be on hand for startup.

Next morning everything went well; engine and air compressors turned over slowly and smoothly. At the 10-min warning whistle we brought units up to speed. Then, when everything seemed rosy, they all began to slow down again. The compressors stopped and the engine was just barely turning over. Just as I started spinning the throttle valve shut, there was a deafening roar from direction of the heater, and the boiler room filled with steam.

When the air cleared, we saw the score. One outlet of a 10-in. T at heater had been blanked off with a tin blank. Ordinarily this would have been OK as the backpressure was only 2 psig. But some sleepy head had put the weighted-lever backpressure valve in upside down so the weight held valve open when steam flow was light. But when we opened up the machines, heavy rush of steam slammed the valve shut, and back-pressure blew the blank.

A H MOULTON *Pittsfield, Mass.*

Middle of the Road on Regulitis

MR KUTSCHER assumes that governors can be tuned to divide load uniformly up and down their full-load range (p 134, May POWER). With duplicate governors and similar rates of wear this may be possible. With dissimilar governors it may be impossible to set up satisfactory paralleling action. Also, drop in speed plus necessary, though slight, voltage drop needed for stability puts regulator at disadvantage. To hold accurate frequency, a necessity for independent plants, adjustments may have to be made frequently with changing load conditions. In such cases, "synchronizing" or load control features should be added to speed governors wherever possible.

If large voltage variations require a voltage schedule, and permissible voltage range is not maintained by automatic means, supplemental rheostats should be used on regulators. Newer regulating devices usually have them built in. Finally, make adjustments when you must but provide the conventional means for doing the job.

C W BELL *Hazleton, Pa.*

Bravo . . .

. . . FOR STEVE SMITH'S story, "The Old Razzmatazz" (p 125, June POWER). Some years back a smart gent out our way tried the same thing Steve's characters did, and for the same reason . . . to scare a greenhorn. Only this guy left a couple of sets of kids without "daddies," and a couple more not much better off. Don't those birds ever learn?

C A GATES *Kansas City, Mo.*

Head First . . . Feet First

THE SPECTACLE of Mr Jahnke with both feet and one arm in a manhole and Mr Riley going him one better by getting in one leg, then head and shoulders (p 125, June POWER), has got me in the same frame of mind as Marmaduke when he roars "Bilgewater." Riley suggests an X-ray of Jahnke, but I would like merely a snapshot of either one of them in their contortionist's position.

Most manholes are 11x15 in., although in later years I have run across some 12x16-in. ones. An ordinary, healthy engineer weighing 175 lb must peel down to coveralls only and make like an eel when entering an 11x15-in. manhole. Quite often the chief does not attempt the feat because, during the years that he has been amassing knowledge and experience, he has also been approaching the size of the boiler drum that contains the manhole.

Riley was justified in criticizing Jahnke for going into a boiler while it was filling. All feed, steam and blowoff lines should be closed tight and have bright red "Danger" tags on them before a man attempts to enter a boiler!

If there is a grating or deck outside the manhole, I find it better and easier to enter feet first and come out by putting one arm out first, with the other laid flat along my side. This position tends to narrow the shoulders. Another important thing: Never enter a boiler or any other drum without posting a man outside to watch you!

I've been crawling in and out of boiler and compressed-air drums for over 40 years, but I'm hoping some boiler inspector gets into this discussion. I've seen some of those boys do stunts that would make Houdini jealous.

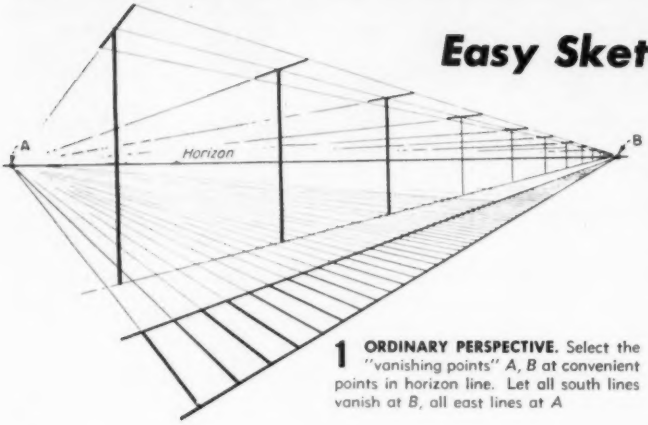
J E GLEASON *Plymouth, Mich.*

This topic has touched off a hot debate, but as yet we've not heard from the boiler inspectors on the subject. How about coming in on it?—ED.

HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH

Easy Sketching System—I



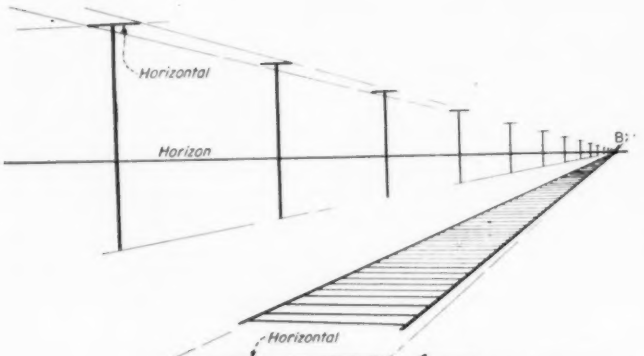
1 ORDINARY PERSPECTIVE. Select the "vanishing points" *A, B* at convenient points in horizon line. Let all south lines vanish at *B*, all east lines at *A*

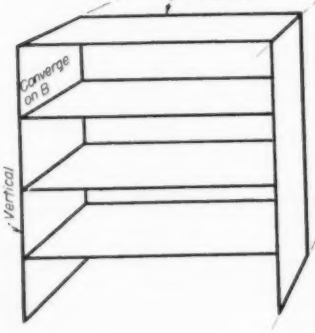
► THIS IS the first of a series showing the easiest known way to sketch mechanical objects in three dimensions. The system to be explained is often called "cabinet," perhaps because it is particularly convenient for sketching furniture.

To get the idea, start with ordinary perspective, Fig. 1. Say, the poles and railroad track run south and the crossarms run east. Note the two vanishing points on the horizon line. All east lines "vanish" at *A* and all south lines at *B*. You can pick *A* and *B* wherever you wish on the horizon line.

Next, imagine point *A* moved left to infinity along the horizon line. Then all the east-west lines become horizontal, Fig. 2.

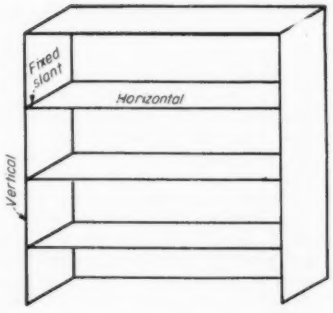
Now note Fig. 3, drawn in cabinet projection. Front of the bookcase is the same as in Fig. 2, and also the same as in an ordinary blueprint front view. The difference from Fig. 2 is that the north-south lines are now drawn parallel instead of converging. This saves work and gives an effect very close to the true perspective shown in Fig. 2.



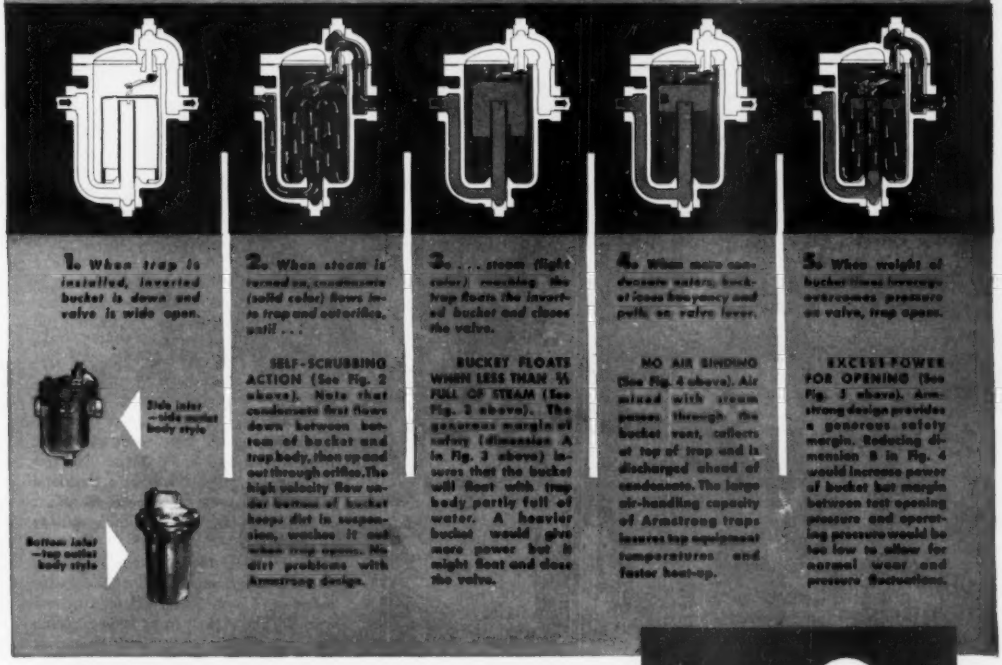


2 MODIFIED PERSPECTIVE. Point *A* is moved to the left to infinity, so the east-west lines will become horizontal

3 BOOKCASE of Fig. 2 is repeated here in "cabinet" projection. The north-south lines are now parallel. That is, they no longer converge



ARMSTRONG TRAPS are Designed to give Outstanding Performance


1. When trap is installed, inverted bucket is down and valve is wide open.
2. When steam is turned on, condensate (solid color) flows into trap and out orifice, until . . .
SELF-SCRUBBING ACTION (See Fig. 2 above). Note that condensate first flows down between bottom of bucket and trap body, then up and out through orifice. The high velocity flow under bottom of bucket keeps dirt in suspension, washes it out when trap opens. No dirt problems with Armstrong design.
3. . . . steam flight color) reaching the trap floats the inverted bucket and closes the valve.
BUCKET FLOATS WHEN LESS THAN ½ FULL OF STEAM (See Fig. 3 above). The generous margin of safety (dimension A in Fig. 3 above) insures that the bucket will float with trap body partly full of water. A heavier bucket would give more power but it might float and close the valve.
4. When more condensate enters, bucket loses buoyancy and pulls on valve lever.
NO AIR BINDING (See Fig. 4 above). Air mixed with steam passes through the bucket vent, collects at top of trap and is discharged ahead of condensate. The large air-handling capacity of Armstrong traps assures top equipment temperatures and faster heat-up.
5. When weight of bucket times leverage overcomes pressure on valve, trap opens.
EXCESS POWER FOR OPENING (See Fig. 5 above). Armstrong design provides a generous safety margin. Reducing dimension B in Fig. 4 would increase power of bucket but margin between test opening pressure and operating pressure would be too low to allow for normal wear and pressure fluctuations.
Side inlet—side outlet body style
Bottom inlet—top outlet body style

THE highly efficient design of modern Armstrong traps reflects over 40 years' experience in inverted bucket trap manufacture and application.

ARMSTRONG design offers:

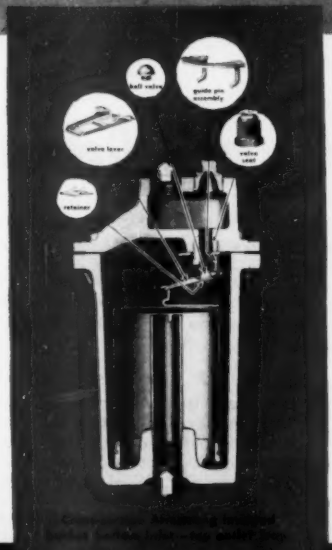
- A "frictionless" leverage system which combines high leverage with wide opening of a large orifice.
- A minimum of parts.
- Strong, corrosion-resistant and wear-resistant materials.
- Generous margins of safety.

FOR TRAP USERS this means:

- Large capacity.
- Dependable service under adverse operating conditions.
- Low maintenance.
- Continuous operation of heating and process equipment.

The soundness of Armstrong design has been proved in thousands of plants all over the world. To insure dependable condensate drainage simply specify: "Traps shall be Armstrong." For additional information, call your local Armstrong Representative or write:

ARMSTRONG MACHINE WORKS
812 Maple Street, Three Rivers, Michigan



● *SEND FOR* NEW 44-PAGE STEAM TRAP BOOK. Complete data on Armstrong trap design and operation; physical data and list prices; capacities; selection, installation and maintenance recommendations. Free on request.

ARMSTRONG STEAM TRAPS

"Marmaduke saw the Chief just in time to toss his bottle into the hopper."

Marmy's 'Dead Soldiers' Live

► AT LONG LAST, one of Marmaduke Surfaceblow's many sins has come home to roost. Just when we had him tagged as the perfect operator, the guy who almost never pulled a boner, this letter comes in from one of his old buddies. Read for yourself.

Dear Editor:

Back in my early teens in Ontario, I read of the spectroscope and, believe it or not, decided to make a prism. The prism was heralded as the heart of the "greatest instrument ever devised by the brain and hand of man."

At my disposal I had the shop tools of an old blacksmith friend. I often helped him with his work. When I asked to use his forge and ladle one day, he told me to go ahead. He didn't even care what I intended to do.

First I hunted up some old bottles of clear glass because I had read that green and other colors contained iron and various impurities. Then I made a three-cornered form of fire clay, by pressing in a wooden section while the clay was wet. My thought was to pour the prism in the rough, then grind and lap it down to a finished state.

After putting the ladle on the fire, I turned on the blower. Then I broke up the glass and filled the pot with it. Hardly had the glass begun to melt when I thought of stirring. I used an iron rod, but on my first attempt, I stirred up glass and bottom of ladle as well.

What I hadn't known was that glass and iron are miscible. Because the presence of glass lowered the melting temperature of the iron ladle, my stirring rod went right through the ladle's bottom and mixed up coke and everything. The molten mixture flowed down into the tuyeres of the forge, doing still more damage.

Years later I had reason to recall that childhood incident and I also profited by it. That was while working as a maintenance man in a power plant that had chain-grate stokers.

When I started there, the plant was troubled by burned stoker links. The coal they burned contained a lot of fines, or buck dust. This was made by the machines that undercut the coal before it was broken up by blasting. At light loads the fuel bed had to be kept thin. And a damaged link always started a hole through the fuel bed. The hole grew large enough to admit considerable excess air by the time it reached the boiler's water back.

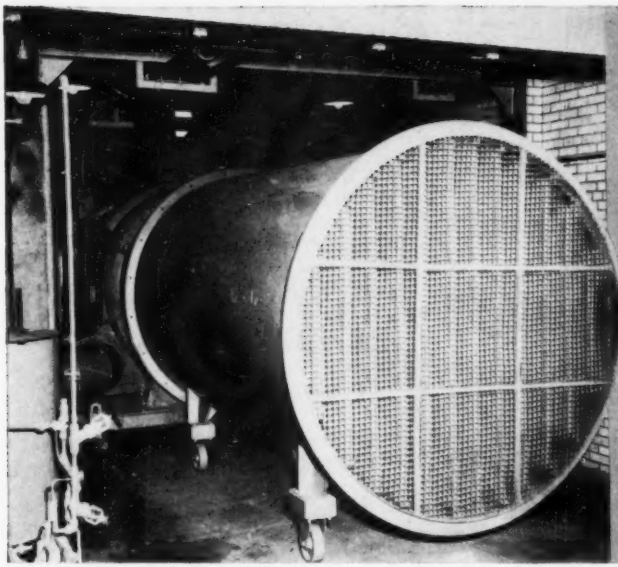
Why the chain stoker links kept burning out was puzzling to all hands. And it was the biggest headache for the management. What made it tougher to track down was that the burning was not confined to any one boiler, or to any area, time or condition of the load. It just happened. Like death and taxes, the expense had to be borne. No record was kept, but certainly a thousand man-hours were used up each year, just to pull rods and replace those ornery stoker links.

I set myself the problem of finding out *why* they burned. But like everyone else, I soon found all my answers wrong. The stoker links kept burning out, sporadically — without rhyme or reason. But they burned, and the work of replacing them continued.

Among the plant employes was a big, tough repair man named Marmaduke Surfaceblow. Marmy was a bruiser in those days but the best all-round maintenance mechanic I ever worked with. He had a red nose, made redder by large quantities of a highly potent and vile-tasting beverage called Sandpaper Gin that he consumed. Contrary to plant rules and strict orders from the Chief, Marmy fortified himself with his favorite drain-pipe cleaner before starting each maintenance job. Then to keep in trim, he ballasted his double bottoms during the job at regular intervals. But the cagey fox kept his bottles hidden, sometimes in the stoker shaft duct, or in the combustion chamber of a boiler that was off the line. Or it might be the coal yard behind the plant.

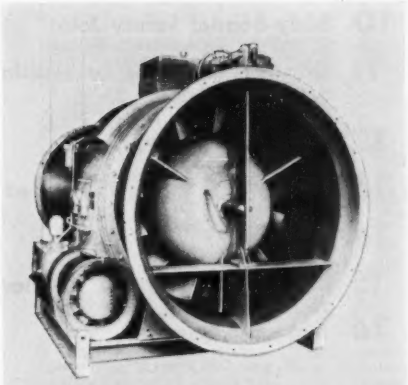
One day the chief engineer almost caught Marmy red-handed. But Marmaduke saw him in time to toss his bottle into the hopper of the nearest stoker. The Chief must have noticed, for he stood around for an hour. I was turbining tubes on a platform above them, and saw the whole thing. I even watched

(*Continued on page* 206)



in JOY AXIVANE® FORCED DRAFT FANS...

...You get *EXCLUSIVE* advantages



JOY Fan with sound-absorbing set removed

The illustration above shows a JOY Axivane Forced Draft Fan (rear) and its sound-absorbing set (front) installed under a pressurized-type boiler in minimum headroom—one of the advantages of its compact, highly efficient vaneaxial design. Other advantages are: favorable air volume-to-power ratio, low noise levels, easily installed, readily accessible, and trouble-free operation with least maintenance.

Principal advantage, however, is the great saving on power at reduced volumes. JOY Forced Draft Fans employ *variable-pitch blades,* manually or automatically controlled, as desired. For example, compared to other volume control methods, at 50% of rated volume JOY Variable Pitch requires only 25% of rated power, against 45% for Vane Control and 70% for Damper Control. ● Let us engineer *your* forced draft requirements and demonstrate the savings possible.

Consult a Joy Engineer

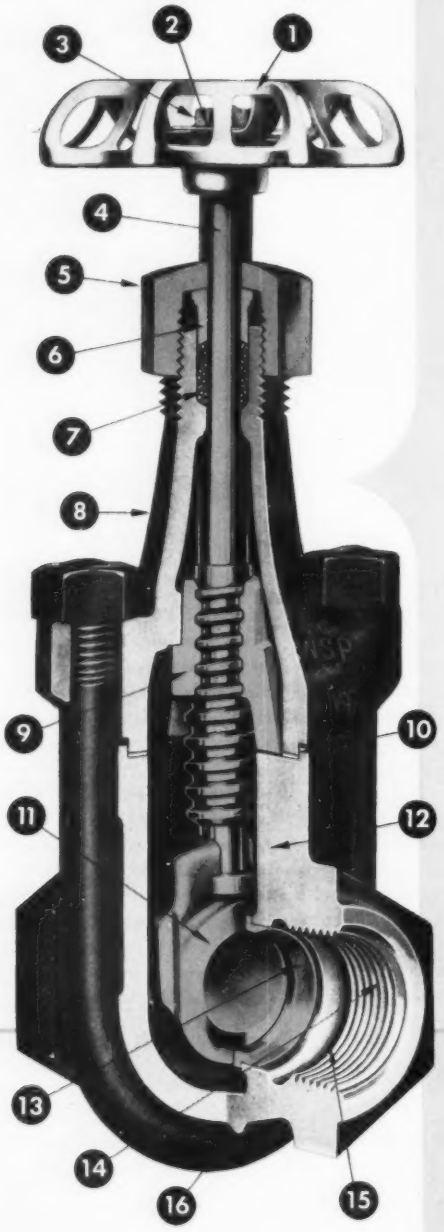
OVER 100 YEARS OF ENGINEERING LEADERSHIP . . . WORLD'S LARGEST MANUFACTURER OF VANEAXIAL-TYPE FANS

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

From U-Bolt to bonnet . . .



1 Perfect-Grip Handwheel

2 Valve Index Plate

3 Secure Wheel Nut

4 Heavy Manganese Bronze Spindle

5 Large Packing Nut

6 Self-centering Packing Gland

7 Deep Stuffing Box

8 Heavy Duty Bonnet

9 Unique Renewable Bonnet-Saver Bushing

10 Body-Bonnet Safety Joint

11 Extra-Wide Gauge Reversible Bronze Wedge

12 Heavy Duty Body

13 Bronze Seat Rings, Expanded in

14 Full Length Pipe Threads

15 Liberal Diaphragm Clearance

16 Strong U-Bolt

JENKINS
U-Bolt Gate Valves

Fig. 42-A, Bronze Mounted Fig. 40-A, All Iron
Screwed: 150 lbs. Steam — 225 lbs. O.W.G. ¼" to 3"

Fig. 43-A, Bronze Mounted Fig. 41-A, All Iron
Flanged: 125 lbs. Steam — 175 lbs. O.W.G. 1½" to 3"

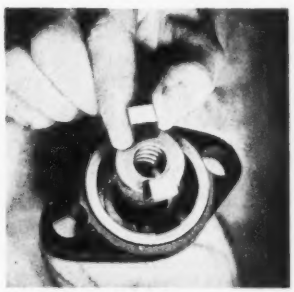
it has SAVINGS written on it

Only Jenkins U-BOLT GATES measure up to this 16-point standard

TROUBLE IS RULED OUT! Check these 16 advanced features—for wear-resistance . . . for ease of maintenance. From handwheel to diaphragm, notice how thoroughly trouble has been ruled out in designing this U-Bolt valve. No other valve in its class measures up to Jenkins U-Bolt Gate on all these points, many of them exclusive.

You can take it apart and put it together again in two minutes, and it's a cinch to clean. When operating threads become worn, just slip in a new "Bonnet Saver Bushing" and restore it to new-valve efficiency. It's a favorite for those plumbing-heating, mine, mill or any services where excessive sediment is tough on valves and where freezing is a hazard. You can get it bronze-mounted or all-iron, screwed or flanged.

For "renewability" without waste, bull-necked endurance, and low upkeep cost, you can't beat Jenkins U-Bolt Valves. Yet they cost no more! Jenkins Bros., 100 Park Ave., New York 17. Jenkins Bros., Ltd., Montreal.



BONNET-SAVER BUSHING— enables you to renew the bushing instead of junking the bonnet. Just slip in a new "Bonnet-Saver Bushing" and spindle threads have a new full bearing in the same old bonnet.

EASY TO CLEAN— You can really get into the bonnet of this valve to clean out the chamber above the operating threads, to remove wear-accelerating sediment.

RUGGED CONSTRUCTION— Here's proof. When the U-Bolt nut was tightened down with a 14" socket wrench until the high tensile steel bolt broke, the heavy duty body and bonnet did not crack!

Get this Jenkins U-Bolt Gate Valve circular, Form 179 B. It gives full details of construction and maintenance, lists dimensions. Ask your Jenkins Distributor, or write Jenkins Bros., 100 Park Ave., New York 17

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

Steel-strike effects will be felt well into early 1953 and may seriously slow expansion programs in major industries, including electric power. Loss of steel ingot production in 1952, from the strike and other work stoppages, came to almost 20 million tons. A 2-step program aims to fight the pinch.

For third quarter of this year, priority is on orders from armed forces, Atomic Energy Commission, machine-tool builders and producers of components for these items. An all-out effort will be made to deliver all second- and third-quarter orders of these priority users by Nov. 30.

Change in CMP rules, for fourth quarter only, forms second step. These order all mills to reserve a percentage of each month's production for military, AEC and machine-tool orders. Required percentages of steel shapes and forms just about equal pre-strike take of these programs. But percentages cover only fourth-quarter needs – carry-over orders, which must be filled by Nov. 30, cannot be included. Also, any mill that gets orders in excess of the percentages from these priority users must still take them – at the expense of non-priority customers.

Restoring arms output quickly to pre-strike levels, rather than full recovery of lost production, is aim of these steps. Non-military items will have to take a back seat while this is going on – with little loosening up in sight until first or even second quarter of 1953. Worst effects may be felt by defense-supporting industries – power-equipment producers, for example – because they also use the "specials" (alloys, heavy plate, castings and forgings) needed by the military. Thus consumer-goods producers may actually get back on the track sooner.

Coal contract bargaining got off to an amiable and informal beginning but what the score will be by showdown time at the end of September is anybody's guess. John L. Lewis will certainly shoot for a better "package" than Phil Murray got for the steel workers but his style will be cramped a bit by the largest coal stocks of any time during the past five years.

Atomic-power reports from four industrial teams agree that commercial production of electricity from atomic energy will be feasible in the near future. They don't look to it as cutting the cost of electric power but as a way of greatly "stretching" fuel reserves.

There's a difference, however, on what should come next. One idea is to build, with government funds, the simplest possible power-producing reactor and see how it works out. Others say that industry, at its own expense, should work up an advanced design, probably using "breeding", in the hope that it would look good enough for private financing.

Control agencies are shrinking as a result of appropriations cuts, will shrink faster after steel-strike headaches have been cured. In the metals field, many small and medium-size companies will be able to write their own tickets after Jan. 1. NPA plans to increase self-authorization limits for steel as follows: Carbon steel, up to 500 tons per quarter from present 60; alloy steel, up to 90 tons from 16; nickel-bearing stainless, up to 10 tons from 500 lb. Copper self-authorization according to these plans will double (up to 20 tons per quarter from 10) and aluminum will increase by 50% (up to 30 tons from 20).

The O. H. Hutchings Station, 12 miles South of Dayton, will have six 60,000-kw units when completed in 1953. All FD and ID Fans in the Station are Sturtevant's famous Turbovane.®

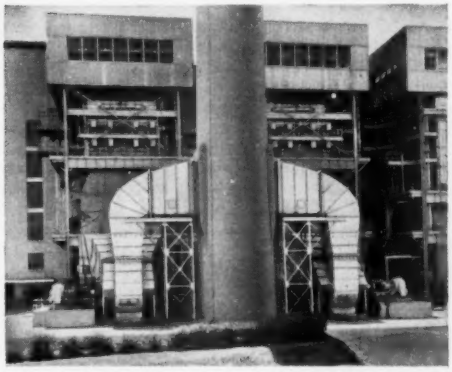
Sturtevant Fans
REDUCE MAINTENANCE
for Dayton Power and Light

At Dayton Power and Light's O. H. Hutchings Station, Sturtevant fans have a tough, long-running assignment. In four years, Unit #1 has burned 530,000 tons of pulverized coal in its dry-bottom boiler. Yet routine checks of the induced draft fans have shown that erosion is negligible.

One of the big reasons for this remarkable record is the time-proven Sturtevant E-R (Erosion-Resisting) wheel. Its special design causes fly-ash to use up its abrasive action on *itself*, and on replaceable liners. Result: many more years of fan life.

Sturtevant fans have also been chosen for the other five units of this important station. That makes a total of 6 forced draft and 6 induced draft Sturtevant fans.

If you want fans you can install and forget, choose Sturtevant. When you do, you get the plus benefit of 92 years experience in the power industry. Call your nearest Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



Expert engineering plus rugged construction of Sturtevant draft fans assure smooth, dependable operation. Exposed service such as this is particularly demanding.

Tune in on history! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.

YOU CAN BE SURE...IF IT'S Westinghouse

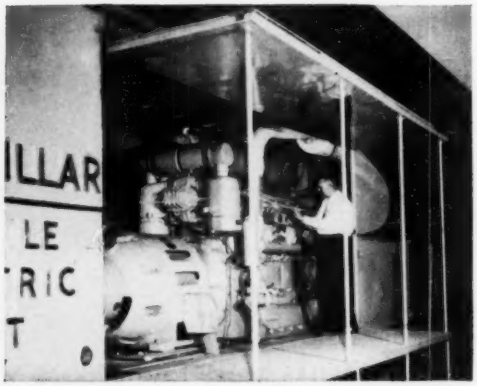
MECHANICAL DRAFT

J-80278

READER SERVICE SECTION

POWER NEWS 164
TECHNICAL BRIEFS 166
PLANT EQUIPMENT NEWS 170
NEW FREE BULLETINS 179

MOBILE electric set is mounted in van-type trailer that weighs under 56,000 lbs, can travel over highways at 60 mph



EMERGENCY power unit generates 315 kw, 3-phase, ac, at 2400 or 4160 v. Trailer carries all necessary accessories

Mobile Power Unit Eases Crisis in South River

► A 315-KW MOBILE ELECTRIC SET, designed for emergency use, helped relieve a serious electrical shortage in South River, N. J., after the main generator at the municipal power plant broke down on July 18.

The "power plant on wheels," built by Caterpillar Tractor Co, has a 315-kw generator driven by a 500-hp diesel engine. It took part of the load off the three remaining municipal generators, which had been running above capacity for almost a week. This firmed up the power, and South River's electrical appliances came back to normal working order on July 24, three days before the main generator was back in operation.

On Friday, July 18, a piston had broken in the 1500-hp diesel engine running the main power plant generator. The two remaining generators and the standby took the load until Monday, July 21, when the town's factories started operation. This load was too great for the three generators, and the power went off.

Rationing worked out fairly well on Tuesday, the 22nd; but one circuit had to be shut off for several hours.

Caterpillar officials in Peoria learned about the trouble on Wednesday. They offered Mayor John Fitzpatrick use of the mobile electric set.

The unit's 315-kw generator and 500-hp diesel engine are mounted in a van-type truck trailer, altogether weighing under 56,000 lbs. Output is 60 cycle ac, 3-phase, on either 2400- or 4160-v transmission. It has its own switchgear, can furnish power directly or synchronize with another power source. At full load it burns about 25 gal of ordinary No. 2 furnace oil per hour.

Because South River's power plant was set up for 2-phase ac, the auxiliary couldn't be used until two Scott-wound transformers had been located in Philadelphia and brought to South River. They arrived on Thursday evening.

When the transformers were installed, Ralph Bradley, Caterpillar development engineer, put one generator into operation at 9:30 Thursday night, taking up the load of partial night shifts in several factories. On Friday the mobile unit took up its full load, and by noon the municipal power plant was up to par in voltage and cycles for the first time that week.

The new piston for the main diesel engine, which had been stalled at the St. Louis factory by a truck strike, arrived at Idlewild Airport in New York on Friday morning. It was Sunday, July 27, before South River's main generator was back in operation.

The mobile electric set that had served the community for three days is the result of more than a year's work to develop the biggest mobile plant ready for use that can be moved at high speed over highways.

The trailer is 32 ft long, 8 ft wide, 12 ft 3 in. high. Its 56,000-lb weight is within the maximum load limits of most states. It can travel at 60 mph, can go anywhere that a large tractor-trailer can go. There is a Western Electric Co radio-telephone for communication.

Special switchgear controls the unit, and current goes through a master switch with an automatic cut-off for safety. Frequency is 60 cycles for all loads. Connections for either 2400 or 4160 volts are made by changing metal bars, eliminating reconnecting and retaping leads.

Guide lights are supplied for synchronizing with an existing power hook-up in the event lines become overloaded or voltage drop is experienced. A reverse current relay trips the main breaker if the diesel engine runs out of fuel, preventing the generator from being motored from the main line.

The engine is air-cooled. Both side panels of the trailer open to admit air and to provide walkways and access to the engine. A fan at the back of the trailer draws air through the radiator at about 2½ tons per hour of operation.

(*More Power News on page* 226)

For **Coming Events** turn to page 228

Easy to Order! . . .

. . . Quick and Easy to Install!

Grinnell Welding Fittings

Any qualified welder can make welds quickly and easily with Grinnell welding fittings. These fittings are made by a hydraulic forging process that assures uniform wall thickness at all points and true circularity throughout. Of seamless, one-piece construction, they can be cut at any angle to match up with standard weight, extra strong and heavier wall pipe in I.D. or O.D. sizes. Pressure-temperature ratings are equal to or greater than those of seamless steel pipe. Grinnell welding fittings are process stress-relieved.

Full data on the complete line of Grinnell seamless carbon steel welding fittings and forged steel flanges is contained in the Grinnell Welding Fittings catalog. Send for a copy.

RANGE OF TYPES AND SIZES

Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge: Nominal Pipe Size	Light Gauge: Iron Pipe Size
ELBOWS 90° Long Radius	½"-30"	½"-30"	1"-12"	¾"-8"	4"-24"	¾"-12"
90° Long Tangent	1½"-12"	1½"-12"	.....	.....	.....	.....
90° Reducing	2"x¾" to 6"x5"		.....	.....	.....	.....
90° Short Radius	1"-30"	1½"-30"	.....	.....	.....	.....
45° Long Radius	½"-30"	¾"-30"	1"-12"	¾"-8"	4"-24"	¾"-12"
RETURNS 180° Long Radius	½"-30"	½"-30"	1"-12"	2"-8"	4"-24"	¾"-12"
180° Short Radius	1"-30"	1½"-30"	.....	.....	.....	.....
180° Ex. Long Radius	1"-2½"	1"-2½"	.....	.....	.....	.....
TEES — Straight	½"-24"	½"-24"	½"-12"	½"-8"	.....	.....
Reducing Outlet	½"-24"	½"-24"	¾"-12"	¾"-8"	.....	.....
REDUCERS Concentric & Eccentric	¾"-24"	¾"-24"	¾"-12"	¾"-8"	.....	.....
CAPS	¾"-24"	¾"-24"	1"-12"	1"-8"	.....	.....
STUB ENDS — Lap Joint	½"-24"	½"-24"				
SADDLES	2"-24"					
LATERALS — Straight	1¼"-24"	1¼"-24"				
Reducing	1¼"-24"	1¼"-24"				
CROSSES — Straight	1¼"-24"	1¼"-24"				
Reducing	1¼"-24"	1¼"-24"				
BACKING RINGS	2"-24"	2"-24"				

Also available in certain sizes are: 90° long and short radius elbows, 45° long radius elbows and 180° long and short radius returns in Schedules 30, 40, 60 and 80.

Grinnell welding fittings and flanges conform to applicable ASA and ASTM Standards.

GRINNELL
WHENEVER PIPING IS INVOLVED

GRINNELL WELDING FITTINGS ARE QUALITY-CONTROLLED FOR DEPENDABILITY

TRUE CIRCULAR SECTION

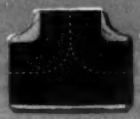
True circular section at all points makes a Grinnell fitting easy to align and weld . . . there is no distortion or no flattening to affect flow adversely.

FULL EFFECTIVE RADIUS

The loss of pressure through Grinnell welding elbows is held down to an absolute minimum . . . because of the full and the effective sweep of the radius.

SMOOTH, CLEAN INSIDE SURFACE

Grinnell Fittings have uniformly smooth inner walls . . . no waves or ridges to cause turbulence or accelerate erosion or corrosion. No pockets to trap solids.



EASY, SWEEPING TURNS

In Grinnell welding tees, corners where outlet joins the run are well-rounded and perfectly smooth to minimize resistance to flow and to prevent trapping.

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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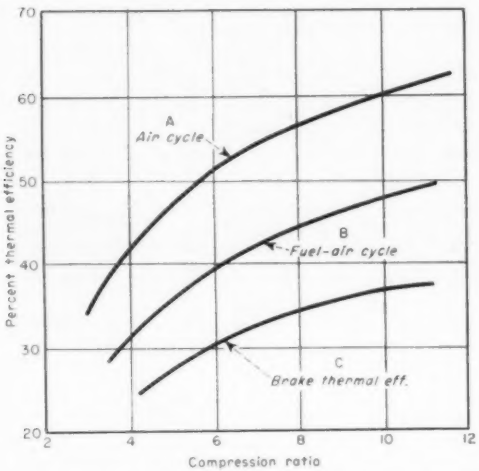
TECHNICAL BRIEFS

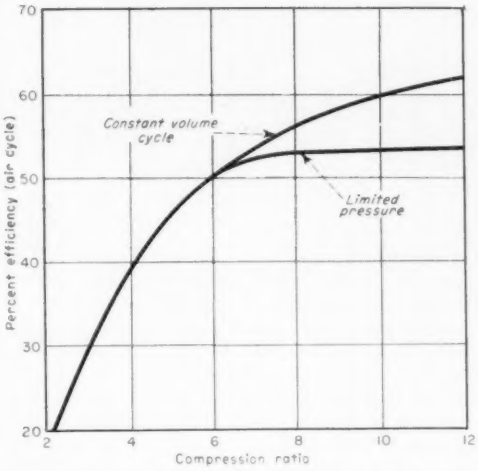
Latest engineering developments for busy power men

II Digests for you on:

GAS ENGINES
LUBRICATION
WATER TESTING
METALS AND MATERIALS



1 Accurate yardstick for gaging engine performance, Curve B above, developed from simple air cycle efficiency Curve A



2 Raising compression ratio puts more available heat into useful work. To limit firing pressure decreases efficiency

Gas Engines

Combustion Fundamentals of Heavy Duty Gas Engines. *By W K Newcomb, Ingersoll-Rand Co.*

Engineering progress in the past decade has set new horizons of efficiency and output for spark ignition engines. Advances in metallurgy and design have contributed generously but the greatest gains have resulted from increasing compression ratio and supercharging.

For many years the spark ignition gasoline engine has been firmly entrenched in the automotive field. More recently use of large spark ignition gas engines has been greatly expanded, due to rapid growth of the natural gas and petroleum industries. The paper reviews combustion fundamentals, shows why this progress has been possible and how it has been made.

If we use the simple air cycle efficiency suggested by Clerk, we obtain Curve A, Fig 1. However, this efficiency is unobtainable because actual working fluid does not follow perfect gas laws. Later investigators have developed the more realistic fuel-air cycle that considers actual fuel composition, change in specific heat of the working fluid with temperature, change in number of molecules before and after combustion, chemical equilibrium, etc. Hence the fuel-air cycle provides a more accurate yardstick for gaging engine performance, Curve B, Fig. 1.

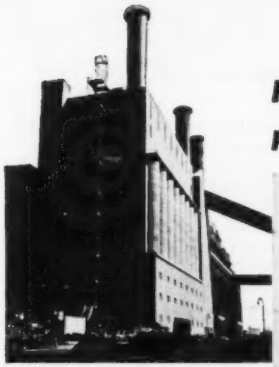
The gain due to raising the compression ratio is two-fold: specific fuel consumption is decreased, and the maximum engine output increased. Both factors contribute to a lower heat rejection rate and put more of the fuel heat value into useful work. However, this gain is not obtained without cost because when compression pressure is increased, the maximum firing pressure is also increased. High firing pressures go hand in hand with high thermal efficiency. One cannot be obtained without the other. This calls for strengthening engine parts and improving bearings. Limiting the maximum firing pressure will decrease the efficiency, Fig. 2. *ASME paper. No. 52-OGP-3.*

Recent Developments in Spark Ignition Gas Engines. *By W N Kauffman, Worthington Corp.*

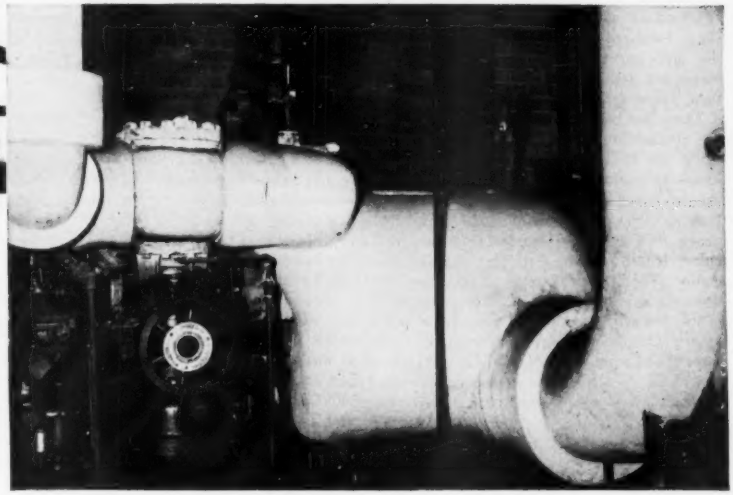
Due to rising costs of fuels, using energy in the most economical way possible concerns all plant operators. This paper indicates the trend toward higher efficiency through research with higher compression engines.

Some 65 years ago, Dugald Clerk recognized that efficiency of the spark ignition engine could be substantially increased by higher compression ratios, limited only by knock. Recent research has repeatedly confirmed these results below compression ratios of 10 to 1. The exponent 1.21 has been checked from spectroscopic, specific heat data as approximating the ratio of specific heats of the expanding gases at temperatures from 3500 to 4000 F.

Detonation, or knock, determines the maximum compression ratio that can be used in an Otto cycle engine. The autoignition theory states that normal combustion is initiated at the spark plug and the flame front moves progressively toward the sides and ends of the combustion chamber. The hot expanding gas in the inflamed region compresses the unburnt mixture of fuel and air ahead of flame, and when a critical combination of pressure and temperature is reached



For this new addition to their New York City power plant at East River and 14th Street . . .



(Above) View of recently completed annex to Consolidated Edison's power plant . . . another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier . . . the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia . . . industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

*Reg. U.S. Pat. Off.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem . . . remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor . . . or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

Skilled Applicators on the team of a J-M Insulation Contractor applying J-M 85% Magnesia to pipelines. Located throughout the nation, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as *quality* products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

More TECHNICAL BRIEFS

Begins on page 166

in the unburned region, it autoignites. If the autoignition occurs with great suddenness (and, therefore at essentially constant volume) it gives rise to sharp localized increase in pressure in the end gas zone. Intense pressure waves are set in motion and these, in turn, cause detonation.

There has been considerable research on combustion of hydrocarbons. As early as 1934 investigations showed knocking characteristics of gaseous hydrocarbons of the paraffin series. These tests clearly showed the increasing tendency to knock with increasing molecular length of the straight carbon chain. The gas having the least tendency to knock was methane. The effect of hydrocarbon molecular structure upon maximum compression ratio indicates that increasing length of the carbon chain greatly increases the knock tendency down to n-heptane, which has zero octane number. The familiar gaseous fuels, methane, ethane and propane are in the narrow chain length group. *ASME paper. No. 52-OGP-2.*

Electrical Ignition of High Compression Engine. *By S E Miller, American Bosch Corp.*

The basic problem in designing a magnetic-energy-storage ignition system is providing a sufficiently fast change of flux linking enough generating winding turns to produce the required high voltage current at the spark plug.

Compression pressures of 500 to 600 psi are now commonplace in engine design. Many difficult ignition problems arise from greater charge density, leanness of the mixture, and capacitative loading of the high tension leads caused by shielding requirements.

In 1946, field tests showed that the reliability of electrical ignition systems for large natural gas engines was limited by the life of the contact points that interrupt the ignition transformer primary current. All systems commercially available at that time employed breaker points. So it was decided to develop a new system without breakers.

The breaker is used only to interrupt the primary current and cause a rapid change in flux in the ignition transformer core. This induces the high voltage necessary to break down the spark plug gap. A pulse of current with a sufficiently steep wave front, supplied to the transformer primary, simulates the transient condition obtained with a breaker system. The initial work, therefore, in developing a breakerless ignition system centered about designing a generator to produce these current pulses. *ASME paper. No 52-OGP-5.*

The Free-Piston Engine Status and Design. *By A L London, Stanford University, and A K Oppenheim, University of California.*

Three applications of free-piston engines came in for consideration: (1) An internal combustion engine air compressor combination where the useful output is compressed air for pneumatic purposes. (2) An air compressor combustion chamber combination for producing hot gases under pressure for use in a turbine to produce shaft work. (3) The compressor system in (1) and a combustion chamber for internal combustion heating of the compressed air and then a turbine to use the hot gases for shaft work.

Performance data for several existing free-piston systems are presented together with the results of cycle studies. The authors compare the thermodynamic design aspect relative to the conventional crank-type reciprocating internal combustion engine system.

The general conclusion is that the free-piston system has the prime advantages of excellent thermodynamic performance combined with mechanical simplicity. Consequently, a major development effort appears to be warranted. *ASME paper. No. 52-SA-17.*

Heat Transmission in Internal-Combustion Engines. *By C Fayette Taylor, Massachusetts Institute of Technology.*

The analogy between certain aspects of heat transmission in internal-combustion engines, and heat transmission by forced convection between fluids and solid surfaces, has been used for some time. This paper discusses some of the limitations of this analogy, and points out how its usefulness can be extended, provided these limitations are observed.

Theoretical difficulties in applying the Nusselt or Stanton relations to heat transmission between the working fluid and the cylinder assembly of an engine include the following:

1. Cyclic nature of the process, with temperatures, velocities and fluid characteristics varying with time and with position in the system.

2. Complex geometry of the flow passages, and the fact that their shape varies with crank position, and thus with time.

3. Appreciable portion of the heat flow, especially while the gases are luminous, is due to radiation.

4. Sonic velocities occur during exhaust, thus introducing a regime that is just beginning to be thoroughly investigated.

5. An appreciable portion of the heat flowing to the cylinder barrel may be due to piston friction.

To these theoretical difficulties are added technical difficulties like measuring surface temperatures, and measuring, or even defining, fluid temperatures, velocities and other important fluid characteristics.

On the other side of the ledger, it may be pointed out that the geometry, at least in the case of four-stroke engines, is pretty well standardized, so that geometric similitude may be assumed in many cases. Also, the working fluid, at any given fuel-air ratio, is substantially a constant factor as between different engines, even though it undergoes violent changes in its passage through any given engine. So relations established by experiments with one cylinder or one engine may quite possibly be extended to other cylinders or other en-

(Continued on page 218)

TO OBTAIN COMPLETE TEXT

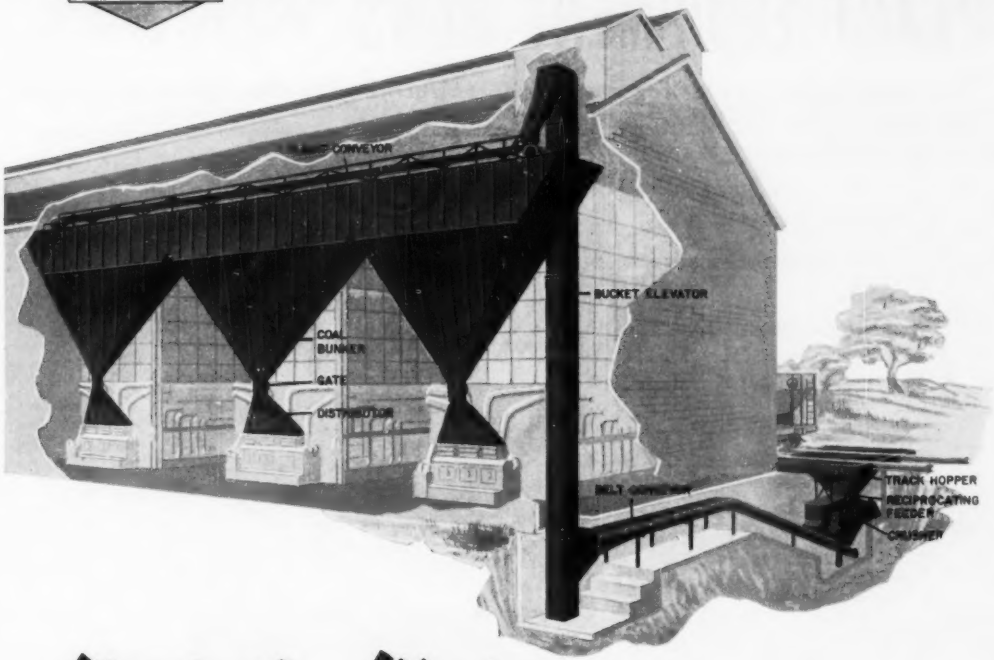
Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from source, not POWER.

American Society for Testing Materials, annual meeting, Statler Hotel, New York, N. Y. June 23-27, 1952. Identified by initials ASTM. Available through ASTM, 1916 Race St, Philadelphia 3, Pa.

American Society of Mechanical Engineers, Oil and Gas Power Div, Statler Hotel, Buffalo, N. Y. June 23-27, 1952, identified by initials ASME, OGP; Semi-annual meeting, Sheraton Gibson Hotel, Cincinnati, Ohio, June 15-19, 1952, identified by initials ASME, SA. Obtainable through ASME, 29 W 39th St, New York 18, N. Y.

American Power Conference, first annual meeting, Sherman Hotel, Chicago, Ill. March 26-28, 1952. Identified by initials APC and obtainable in official proceedings. Available through RA Budenholzer, Illinois Institute of Technology, 3300 S Federal St, Chicago 16, Ill. $6.00.

FAIRFIELD SERVING THE NATION'S POWER PLANTS



Norfolk and Western Railway Company

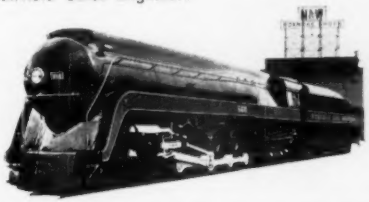
shops use Fairfield coal handling equipment

At the Roanoke, Va., shops of Norfolk and Western, where the giant N & W locomotives are built and repaired—Fairfield Engineering handling systems provide coal for boilers which generate vital steam for the vast Norfolk and Western shops, office buildings and passenger station.

As all Fairfield systems, this Norfolk and Western installation is a completely integrated system of quality construction. The coal flows from a track hopper, through a reciprocating feeder, into or around a crusher and then to a belt conveyor equipped with a magnetic pulley. The belt conveyor feeds a continuous type bucket elevator which lifts the coal to the double strand flight conveyor, where it is fed by gates to the steel bunkers and finally to the distributors above the boilers for predetermined boiler feeding. Fairfield performance, as well as planning and construction, played an important part in Norfolk and Western's selection of an additional coal handling system by Fairfield for its Portsmouth, Ohio shops..

Whatever your coal or ash handling requirements—or specialized bulk material handling, too—it's a wise investment to talk to the local Fairfield Sales Engineer. Write us today for further details and the name of your local Fairfield Sales Engineer.

FAIRFIELD

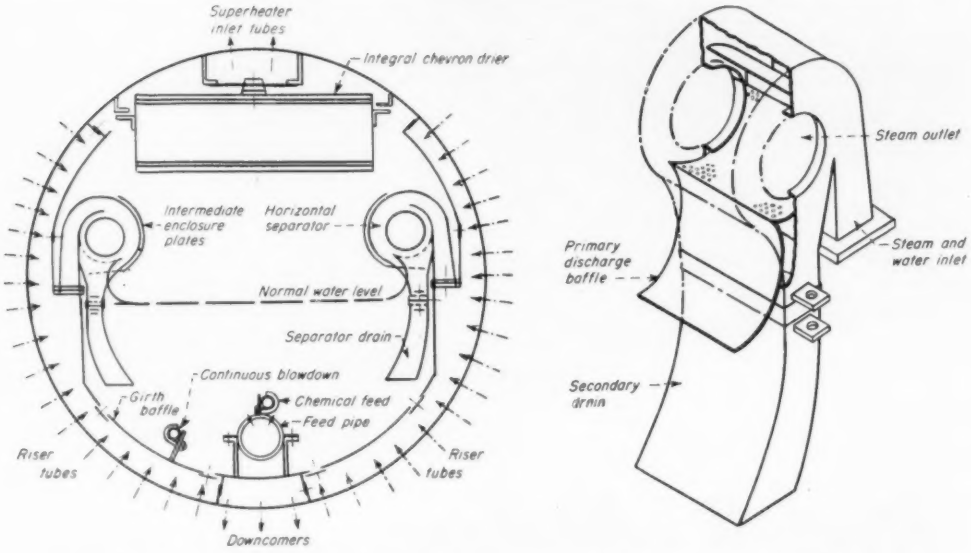


THE FAIRFIELD ENGINEERING COMPANY, 335 CHICAGO AVE., MARION, OHIO

PLANT EQUIPMENT NEWS

Your information center for new products designed to solve plant problems

Published monthly as a service to readers



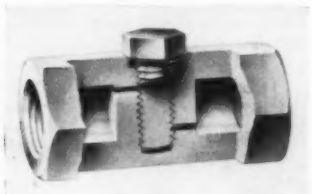
STEAM-WATER SEPARATOR COMBINES HORIZONTAL SEPARATOR AND UNIT CHEVRON DRIERS

P955 • A good set of steam drum internals should successfully fulfill the following basic requirements: (1) Provide high purity steam to prevent superheater tube burnouts and avoid reducing turbine capacity. (2) Water entering downcomers should be steam-free to keep circulation at maximum. (3) Normal water level changes should not affect steam purity. (4) Boiler water concentration should not affect steam purity. (5) Pressure drop in separators should not be excessive enough to reduce circulation. (6) Arrangement of drum internals should give maximum accessibility. (7) Installation and removal time should be minimum.

Arrangement that best satisfies these requirements involves two stages of separation: (1) Horizontal centrifugal separators. (2) Unit driers arranged in the steam space that extract last traces of water remaining after first separation.

Horizontal separator is shown above, right. Steam-water mixture leaving generating tubes is first guided by girth baffles, then enters separators through rectangular inlet openings. Separation starts when mixture assumes a curvilinear flow path, and is complete after mixture has traveled less than one complete turn. Water returns to drum through outlet horizontal to water level in drum and has sufficient kinetic energy to overcome increase in drum water level above opening. Steam from separator enters unit chevron drier assemblies arranged along drum on equal centers.

Extensive tests and operating experience gained from first few installations have shown that fundamental requirements are being met by drum internals consisting of horizontal separators, unit chevron driers. **Foster Wheeler Corp, 167 Broadway, New York, N.Y.**



For more data on these items, use post cards, p179. Identify request with P and number.

AIR FLOW SNUBBER

P921 • Air flow snubber and pulsation damper provides a controlled flow rate of compressed air or gas for operation of continuous-reading hydrostatic instruments and for purging pneumatic instrument lines. It also protects pneumatic testing and gaging equipment against damage that might result from surge pressures by providing a flow restriction in the line.

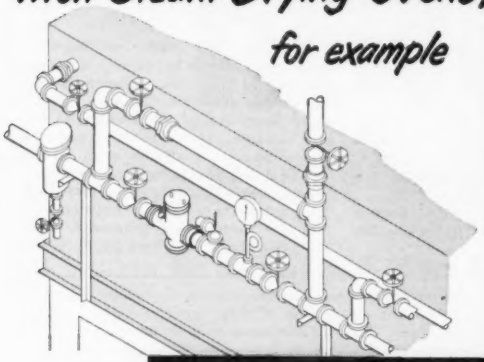
Flow rate is approximately 0.04 cfm at a pressure drop of 70 psi. Maximum operating pressure is 1000 psi. Bulletin 317. **King Engineering Corp, Box 530, Ann Arbor, Mich.**

POCKET SIZE METAL HARDNESS TESTER

P904 • Although standard metal hardness testing equipment weighs hundreds of pounds, this pocket-size instrument weighs just 7 ounces. Yet it is claimed to be as accurate as the larger equipment. Hardness is checked by rebound of chrome-plated

Are Your Pressure Regulators Doing As Well?

...on Steam Drying Ovens, for example



THE INSTALLATION

In steam supply line to battery of 2 drying ovens at Ferro Chemical Corporation, Bedford, Ohio. Ovens individually controlled by thermostatic valves.

THE HISTORY

Specifications called for a valve to reduce initial steam pressure of 70 psi to 13 psi, and to maintain reduced pressure automatically without significant fluctuation whether one, or both, or neither oven is operated. Ovens to be operated at same or different temperatures, depending on process requirements.

Specifications were met with one No. 960 Crane Pressure Regulator, properly selected for capacity, and installed with adequate drainage of condensate.

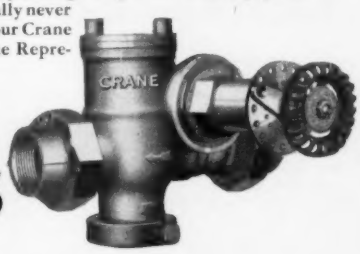
In service now more than 5 years without interruption, Crane Pressure Regulator is giving complete satisfaction. Working like new; maintenance cost to date: zero. Remarkably simple to adjust.

VALVE SERVICE RATINGS

SUITABILITY:	Does everything claimed for it
MAINTENANCE COST:	None; working like new
CORROSION-RESISTANCE:	Steam only - corrosion no problem
SERVICE LIFE:	In 5 years; no sign of wear
OPERATING RESULTS:	No fluctuation of oven heat
PRICE:	Good buy
AVAILABILITY:	Regular Crane item

THE VALVE

Crane No. 960 Brass Pressure Regulator reduces 250-Pound steam or air inlet pressure up to 80%. Available for operation at any of 4 pre-set ranges within 1 to 200 pounds outlet pressure. Adjusts easily within any set operating range. All wearing parts renewable; virtually never wears out. See your Crane Catalog or Crane Representative.



The Complete Crane Line Meets All Valve Needs. That's Why

More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois

Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

More EQUIPMENT NEWS

Begins on page 170

hardened-steel hammer. Readings are made directly from one of three scales without conversion tables.

Work can be tested while in position on lathe. Instrument can also test internal mold and die sections with areas as small as 1 sq. in. There are no diamond points to grind or wear out, no penetrating ball to deform.

Peabody Industries, Inc, 1819 Broadway, New York 23, N.Y.

SPRAY GUN SUPPLY PUMP

P926 • The air-operated, double-action reciprocating pump, working directly from 5 or 10 gal original containers, is designed for easier handling of paints and materials by plant maintenance departments. *Paintmaster's* separate air-operated, dual-bladed agitator keeps materials perfectly mixed—independent of paint pump operation. Blades of non-sparking aluminum are adjustable to any depth. Since no air pressure is exerted on material, aeration is reduced to minimum.

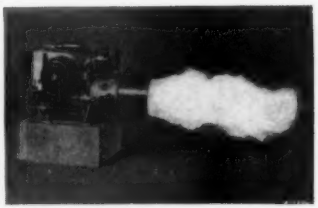
Gray Co, Inc, 1012 Sibley St, Minneapolis 13, Minn.

TERMINAL STRIPS

P949 • Strip is made so circuits can be opened and closed for testing by a sliding link without disturbing any connected wire. Sliding links are flanged to lock nuts in place preventing turning or contacting neighboring circuits.

Brach Mfg Corp, 200 Central Ave, Newark, N. J.

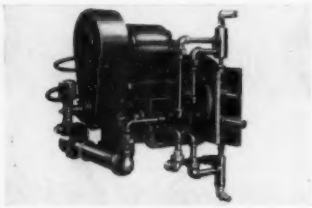
For more data on these items, use post cards, p179. Identify request with P and number.



COMMERCIAL BURNER

P956 • Known as AM5-H and AM6-H, these burners feature installation ease, flame protection by electronic relay, and direct connected pancake motor. AM5-H has 25 gph capacity, 20 in. overall width, 2 hp pancake motor, and measures 8½ in. from floor to center of combustion cone. AM6-H has 40 gph capacity, larger oil pump, and larger dry oven and air diffuser.

Cleaver-Brooks Co, Hev-E-Oil Burner Div, 326 E Keefe Ave, Miwaukee 12, Wis.



ROTARY BURNER

P957 • Originally made for *Superior* steam generators only, burners are now available for conversion, replacement and new installations. Units feature: (1) horizontal rotary design, (2) V-belt drive for high cup speed, (3) oil heater on pressure side of pump, (4) adjustable air nozzle, (5) dual pumps and reservoir combined with constant oil-rate control for controlled firing regardless of viscosity variation.

Superior Combustion Industries, Inc, 1475 Broadway, New York 18, N. Y.

POWER's apologies to the Cleaver-Brooks Co and Superior Combustion Industries, Inc, for switching the pictures of their respective burners (p158, 160 Aug POWER). They're shown above correctly oriented.

MINIATURE INDICATORS

P950 • Liquid level and valve position miniature indicators occupy minimum panelboard space. Both units are similar in appearance, differences being in color of indicating tapes and availability of alarm switches on level indicator.

Indicators give illusion of a liquid level sight glass by using a colored metal tape that moves vertically behind indicating scale. Reverse or direct action is obtained by a linkage attached to a standard 3-15 psi pneumatic receiver, which provides sufficient force to eliminate tapping error.

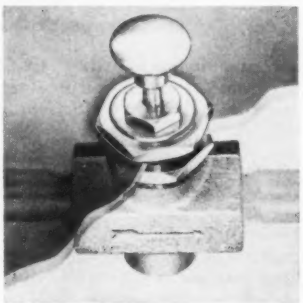
Minneapolis-Honeywell Regulator Co, Industrial Div, Wayne and Windrim Aves, Philadelphia 44, Pa.

PROTECTIVE PLASTIC COATING

P909 • *Ricwilite* coatings protect equipment against corrosive conditions with a tough, impervious film, resistant to acids and alkalis, salt water, rust and weathering. Coatings will protect ventilating and duct systems, drill pipe, piping and equipment in food and chemical process plants, oil refineries, pulp and paper plants, sewage lines, tank cars, etc.

Two types are available: (1) *Ricwilite 1060 Phenolic Resin Coating*, a heat hardening type baked at 350 to 400 F. (2) *Ricwilite 7100 Phenolic Resin Coating*, a cold setting type cured by addition of catalyst just prior to application. It can be applied by brush or spray to almost all metals, concrete, wood and plaster surfaces.

Ric-Wil Plastic Coating & Mfg Corp, 1290 Euclid Ave, Cleveland 15, Ohio



SELF-CLOSING PUSH VALVE

P958 • This push valve is used in gas and air lines where manual control of intermittent flow is required and where there must be no leakage through valve or around valve stem. Valve is opened by pressing knob on valve stem and closed automatically when knob is released. It has no compression packing and requires no adjustment, being packed by neoprene O-rings. On breakdown test, valve showed no leakage after 1,000,000 operation cycles.

Two styles are available: Model PV (shown above) for mounting on panels up to 7/16 in. thick, and Model LV for in-the-line mounting. Inlet and outlet are tapped for ¼-in. pipe, arrow shows direction of flow. Discharge rate is 25 to 30 cfm at 100 psi pressure drop. Full details in Bulletin 304.

King Enginering Corp., Box 520, Ann Arbor, Mich.

(*Continued on page* 174)

Revere

Electric Welded Steel Tubes

Hot and Cold Rolled Carbon Steel up to 1025 Carbon

Round
Square
Rectangular
Special Shapes

Diameters from ¼″ O. D. to 4½″ O. D.
Wall thicknesses from .025″ to .187″

● If you require Electric Resistance-Welded Steel Tube, we suggest you get in touch with Revere at once. On many requirements, exceptional deliveries can be made. Investigate this source of supply.

Complete facilities are available for further fabrication such as cutting, swaging, bending, annealing, testing, etc.

If you are equipped to do your own fabricating, you will find Revere Electric Welded Steel Tubing has uniform properties and can be readily formed for varied applications.

Over 25 years of experience in the manufacture of Electric Welded Steel Tubes.

Technical and Engineering service is available. Consult us on your Steel Tube problems.

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

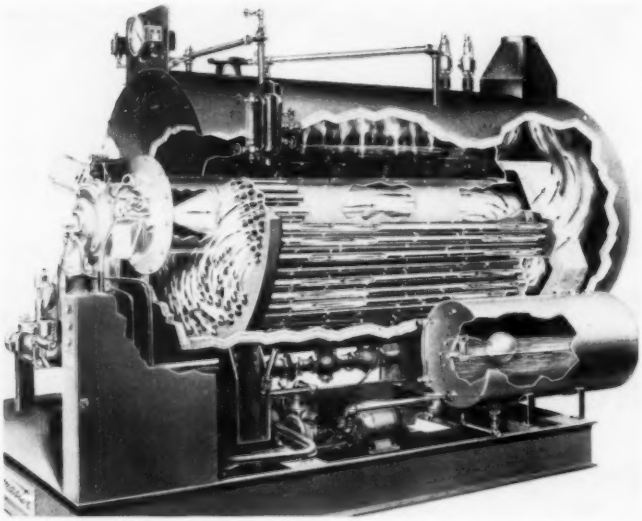
• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

More EQUIPMENT NEWS

Begins on page 170



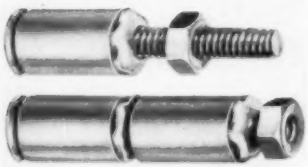
PACKAGE UNIT BOILER WITH THREE-PASS CONSTRUCTION

P905 • *Powermaster* horizontal fire-tube boiler has three-pass internal furnace construction for high efficiency and economical operation. *Voriflow* burners for light and heavy oils and for commercial gas fuels as well as dual combination burners modulate with uniform high efficiency between 30 and 100% full load rating.

Combustion gases travel through central combustion tube, reverse their flow back through lower tube bank, then return to flue through two lateral tube banks. Boiler feed and condensate handling system is optional. Integrated control system and interlocking safety devices are integral part of each unit.

Powermaster boilers are built in 16 sizes, from 15 to 500 hp, for pressures up to 250 psi. Heat transfer is about 4.5 to 5.0 sq ft per bhp. Bulletin 1218.

Orr & Sembower, Inc, Morgantown Rd, Reading, Pa.



ANCHOR BOLT

P903 • New single- and double-anchor bolt assemblies are guaranteed to give 50% greater anchorage and can be used wherever anchor bolts or expansion bolts are used. Available in bolt sizes from 3/16 to ½ in. and up to 5 in. long, anchor can be put in masonry, brick, wood, etc. at any angle; bolt can then be bent or off-set without disturbing anchorage.

Super-Grip Anchor Bolt Co, Inc, 3333 N 22nd St, Philadelphia 40, Pa.

PIN-POINT SOLDERING IRON

P939 • Iron weighs only 3 oz (less cord) with a ⅛-in. diameter tip. It is rated at 25 watts, and is suitable for soldering fine instruments, small electronic devices. Unit has nickel-chromium, mica-wound mounted element. Can be furnished for either 110 or 200 v. Catalog No. P-25.

Hexacon Electric Co, 131 W Clay Ave, Roselle Park, N. J.

For more data on these items, use post cards, p179. Identify request with P and number.

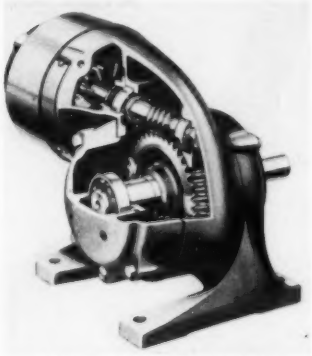
THERMAL OVERLOAD RELAY

P938 • Type TRO thermal overload relay for power transformers is now equipped with an indicating dial. Calibrated in percent thermal load, the dial gives a continuous visual indication of thermal condition of transformer.

The term "percent thermal load" has a universal meaning under any ambient temperature. It needs no interpretation in terms of time-temperature limits of winding insulation or possible loss of life due to overloading. Coordinated with the relay, the 100% position on the dial corresponds to "signal" position of relay, and 110% to "trip" point.

Easily read from ground level, the dial also has a maximum indicating hand that remains always in position of greatest deflection of indicating pointer. Maximum point can be reset manually from the ground level. Dial readings range from 60 to 120% thermal load.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



ANGLE WORM-GEAR MOTOR

P951 • Low speed right-angle worm-gear motor type GW incorporates a cantilever design to protect gear alignment. Unit uses splash lubrication, a hardened and ground worm, leakproof oil seal and asbestos-protected windings.

Motor is built in speed ranges from 20 to 155 rpm and gear ratios up to 58:1. It is made in both 3-phase and single-phase, ratings ¼ to 3 hp. Bulletin No. 1650.

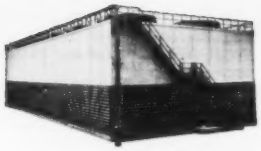
U. S. Electrical Motors Inc, P O Box 2058, Los Angeles 54, Calif.

ARMORED CABLE

P943 • Sizes No. 14 to 10 Awg of BX cable now have a glass braid instead of customary cotton. Inorganic glass braid will not rot and is flameproof. Most important, it makes possible a smaller overall diameter of cable. Reduction of steel armor size also gives a corresponding reduction in weight.

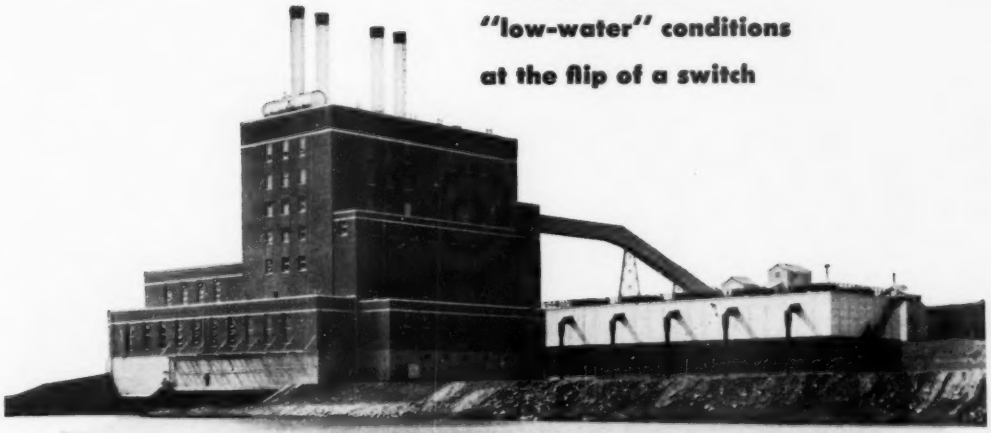
General Electric Co, Bridgeport 2, Conn.

(*Continued on page 176*)



a standby for nature

—ready to meet "low-water" conditions at the flip of a switch



This new, ten-cell Foster Wheeler cooling tower was installed by a major southern power company for the sole purpose of meeting their cooling needs when the water level of the river drops too low.

Sheathed with fire-proof asbestos board, this installation cools 50,000 gallons per minute from 114° to 91° F with a spray and evaporation loss of less than 2.5%.

For power generation, oil refining or chemical production—year-round or intermittent operation—there's a Foster Wheeler cooling tower to meet your particular requirements. Each tower is engineered and constructed to give you maximum performance at minimum cost.

Get the whole story...

Send for this new, well-illustrated catalog today. Includes helpful information on tower design for freezing climates, effects of recirculation and surroundings on performance, in addition to complete description of sound construction and high-quality materials to which Foster Wheeler customers have long been accustomed.

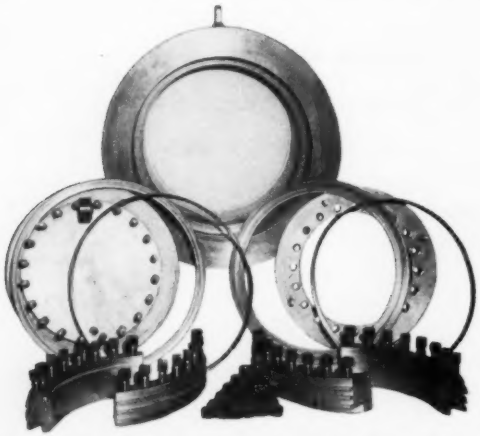
A data sheet is bound into the catalog to aid you in writing the specifications for the cooling tower which will best meet your needs. Write for Catalog CT-52-4 to:

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

More EQUIPMENT NEWS

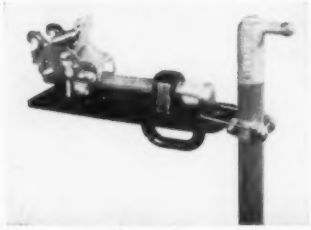
Begins on page 170



HIGH PRESSURE CLOSURES FOR FEEDWATER HEATERS

P954 • New closure for high-pressure feedwater heaters and other high-pressure equipment has two main features: (1) All hydrostatic end load is removed from the screwed fastenings. (2) The locking device plus the screwed fastenings are external to the gasket seal and thus protected from the corrosive effect of the contained fluid. Closure is rapidly demounted and reassembled for inspection and maintenance. All pressure-resisting members are so designed and arranged that they need be no heavier than necessary to withstand the hydrostatic end forces and maintain a positive seal. Further, gaskets can be replaced without removing the cover. If necessary, bolting may be retightened under full pressure conditions.

American Locomotive Co, Alco Products Div, Dunkirk, N.Y.

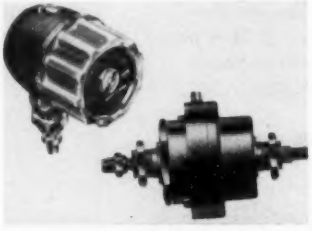


SWITCHSTICK ATTACHMENT

P940 • Attachment permits easy switchstick-operation of cutouts, including removal or replacement of cutout doors. Device is a stainless steel fitting for clamping to head of any standard switchstick.

It can be used for switchstick-handling of doors with all GE enclosed, indicating, dropout cutouts, 5.2- or 7.8-kv, 50- or 100-amp, manufactured since 1935, and with GE 5.2-kv, 100 amp heavy duty cutouts.

General Electric Co, Schenectady 5, N. Y.



HYDRAULIC POSITIONER

P922 • *Hydrotorque* is a hydraulic positioning control system designed for extreme accuracy and power at remote distances. It will hydraulically position valves, throttles, engine speeds, winches and brakes, diesel engines, metering nozzles and a wide variety of other mechanical devices. It will also indicate level, flow, static pressure, repeaters or temperature. Dials calibrated to custom requirements, can read in inches of water, psi, gpm, up-down or any given designation. Unit is made in bronze, cast iron, cast steel, needle or 3-way.

Farris Hydrotorque Corp, Engrg Dept, 627 Commercial Ave, Palisades Park, N. J.

For more data on these items, use post cards, p179. Identify request with P and number.

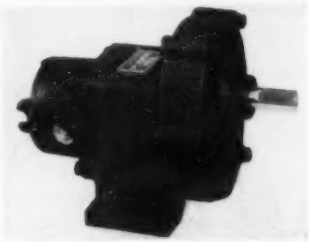
CHECK THESE TOO! . . .

Controlled Volume Pump ..... p 184
Pipe Insulation ..... p 186
Gate Valve ..... p 188
Liquid-Level Control ..... p 190
Non-Acid Flux ..... p 192
Purifier, Internal Downflow ..... p 196
Pound-Chart Recorder ..... p 200
Air Blaster ..... p 202
Diesel Pyrometer ..... p 204

TAPE SOLDER

P959 • Manufactured in the form of a metallic tape, this 40/60 tin-lead solder contains a rosin flux. A single package is capable of 100 connections. Waste is eliminated, and no soldering iron or tools are needed. Soldering connection can be made with a single match or candle.

The Blonde Oil Co, Solder Div, 464 Woodward Ave, Brooklyn, N. Y.



LOW-SPEED TACHOMETER HEADS

P960 • Heavy-duty tachometer heads measure speeds as low as a fraction of an rpm. Series 57M heads are used with *Metron* tachometer indicators, recorders or controls, measure speeds of extruders, welders, kilns, conveyor belts, ovens, dryers, etc. Built-in gearing permits direct connection to very low speeds without speed-changing drives, and up to 199 rpm can be measured. Overspeeding of 2 to 10 times rated values results in no damage.

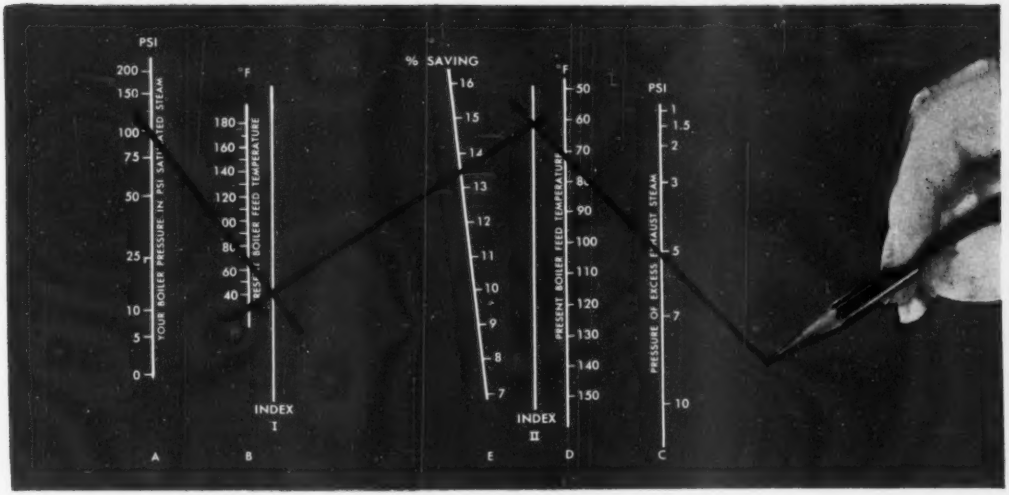
Stainless-steel head shaft is ¾ in. in diameter and supported in large, sealed ball bearings. Head casting is anodized aluminum with ⅝-in. wall and heavy mounting feet. All working parts are completely enclosed. Electrical connections between head and speed indicator can be 1000 ft or more apart. Connections to the head can be made from any one of four approaches and head can be mounted in any position.

Stable performance is assured over wide range of temperatures, humidity, vibration or magnetic fields. Permanent lubrication is used throughout, and all heads of same type number are completely interchangeable.

Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

(*Continued on page* 184)

Use exhaust steam and cut fuel costs with a Swartwout Feed Water Heater

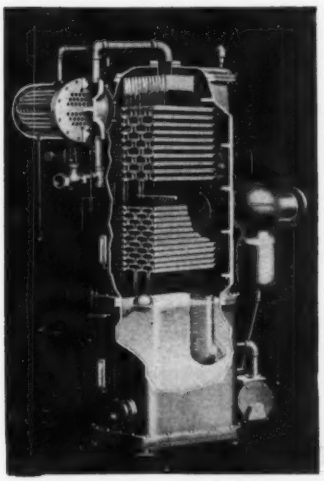


1 UTILIZING RESIDUAL HEAT in exhaust steam, you effect a direct saving in fuel costs of approximately 1% for each 11°F increase in boiler feed water temperature. Furthermore, you improve boiler operation in other important, cost-cutting ways. Faster steaming rate . . . removal of the soluble gases that cause costly corrosion in boiler and economizer . . . reduction of temperature strains.

Here's how to figure your fuel savings. Connect point on A to point on B; project line to intersect Index I. Connect points on C and D; project line to intersect Index II. Connect points on I and II and read your fuel savings on Scale E. The example given (100 psi saturated steam boiler using 70°F feed water and 5 psi exhaust steam) shows a *saving of approximately 13.6% of your present fuel cost.* A-6063

Swartwout

POWER PLANT EQUIPMENT
PROCESS INDUSTRY CONTROLS
INDUSTRIAL VENTILATION

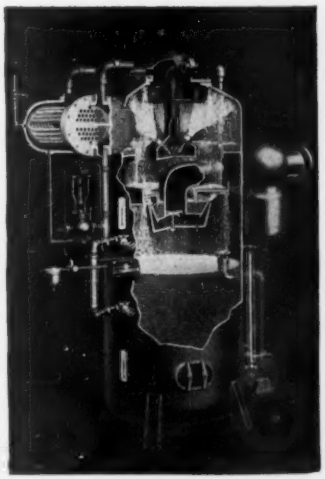


2

SWARTWOUT TRAY TYPE HEATERS, by using counterflow principle, give greatest degree of deaeration because water is in contact with clean steam just before dropping into storage section. Swartwout cast iron or steel deaerating heaters (.03 oxygen guarantee) and deaerators (.005 oxygen guarantee) can be supplied with cast iron or stainless steel trays.

3

SWARTWOUT SPRAY TYPE (atomizing) deaerators are of all-steel construction, give feed water with oxygen content guaranteed not to exceed .005 cc per liter of water. All surfaces which are subjected to impingement of water are made of corrosion-resistant stainless steel. Swartwout feed water heaters are specially designed to meet your individual requirements and range from 5000 to 300,000 lb. capacities.



SEND FOR BULLETINS S-18-E, S-210 • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

ILLCO-WAY ionXchange

serving the essential power plants of American industry

pioneers and leaders in ionXchange

ILLCO-WAY "firsts" include manufacture of the first commercial two-bed De-ionizer . . . the first commercial mixed-bed De-ionizer . . . and the development and building of the first successful installations for the purification of such liquids as beet-juice and crude glycerol by ionXchange . . . In the power field, boiler feed water treatment by ILLCO-WAY ionXchange has long meant lower operating costs and increased operating efficiency. Installations in leading plants.

ILLCO-WAY

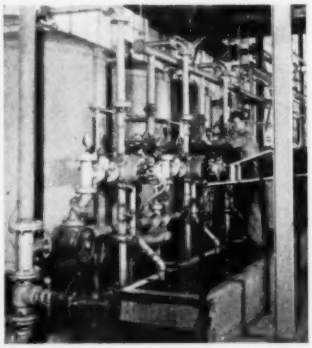
DE-IONIZING
DE-ALKALIZING
SOFTENING

For complete data, see Sweet's File, Power Plant

ILLINOIS WATER TREATMENT CO., 853-3 Cedar St., Rockford, Illinois
141 East 44th Street, New York 17, N.Y.
Canadian Distributor: Pumps & Softeners Ltd., London, Ontario

(Advertisement)

CASE HISTORY



CATERPILLAR TRACTOR CO.

Steam costs have been cut and efficiency has been boosted at Caterpillar Tractor Co. plant, Peoria, Illinois, by means of an Illco-Way simplified modern boiler water conditioning system.

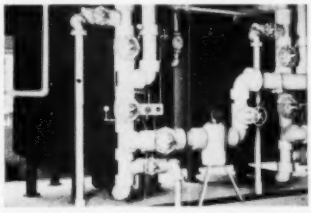
Caterpillar operates twelve 630 HP boilers on de-alkalized water. The boilers can be operated at 200 percent capacity, or at 1260 HP.

Use of Illco-Way equipment, shown above, has reduced blow-downs by approximately one-half of former requirements. Continued use of de-alkalized water is expected to produce even greater blow-down reduction in the future.

Over months of operation, the savings on make-up water have been very pronounced, Caterpillar reports. During normal operations, an estimated 100,000 gallons per day on make-up water are saved by using Illco-Way equipment, as a result of elimination of excessive blow-down.

Illco-Way de-alkalizing equipment produces water suitably low in alkalinity, reduced in solids content, free of hardness, at a cost comparable to softening.

Illco-Way equipment, used in America's outstanding plants, includes the recently-developed Mixed-Bed De-ionizers, Hydrogen-Zeolite Units, Zeolite Softeners, Degasifiers, Filters.



WESTERN ELECTRIC CO.

A peak of 60,000 gallons per hour of softened water is produced by the above Illco-Way Triplex Softener, semi-automatically controlled. Water is free of hardness and scale-forming properties. For other installation data and complete description of Illco-Way softening equipment, send for Bulletin A. Please write on company letterhead. Address Illinois Water Treatment Co., 853-9 Cedar St., Rockford, Illinois.

Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

Now free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

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This month's FREE Literature

BOILERS AND AUXILIARIES

B1 **BOILER BUILDERS**—Dry back type for high and low pressure installations. 12-page bulletin B111 gives dimensions, features, diagrams, installations of 30 to 250 hp units. Dominion Bridge Co, Ltd, P O Box 220, Montreal, Que.

B2 **ROTARY BURNERS**—Operate with oil or in combination with gas. Capacities 5 to 167 gph of oil. 8-page bulletin gives features, photos, operation. Superior Combustion Industries, Inc, Times Tower, Times Square, New York 18, N.Y.

B3 **DUST COLLECTOR APPLICATIONS**—Use of Dustex type cloth tube collectors in 22 typical installations. 14-page booklet gives photos. American Wheelabrator & Equipment Corp, 1441 S Byrkit St, Mishawaka, Ind.

B4 **GAS BURNER NOZZLES**—For industrial heat processing applications. 4-page bulletin 504C gives capacities, dimensions, illustrations of Return-a-Flame line, straight and elbow types. Hauck Mfg Co, 124-126 Tenth St, Brooklyn 15, N.Y.

ELECTRICAL AND MECHANICAL CONTROLS

B5 **CONTROL THERMOMETER**—Three-O-Two unit with snap-action electronic control. Indicating or recording type. 4-page specification sheet 509 gives specifications, operation. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 44, Wayne & Windrim Aves, Philadelphia 44, Pa.

B6 **MOTOR CONTROL CENTERS** — Provide flexibility through interchangeable plug-in units. 8-page Consentrol bulletin 409 gives photos, dimensions, layout information. Continental Electric Equipment Co, Box 1654, Cincinnati 1, Ohio.

B7 **FLOW RATE REGULATORS** — Control liquid flow rate despite pressure fluctuations. 4-page bulletin 121 describes operation, gives capacities, uses. W A Kates Co, 480 Waukegan Rd, Deerfield, Ill.

B8 **OIL DAMPED SOLENOIDS** — Produce smooth, quiet, hand-like motion. 12-page bulletin gives photos, diagrams. Scully Machine Co, 42 Walter St, Bridgeport 5, Conn.

B9 **BUBBLER CONTROLS**—For liquid levels. Bubbler unit replaces floats and electrodes. Pressure-operated self-contained unit with independent high and low settings. 2-page bulletin 1554 gives operation, photos. Automatic Control Co, 1056 University Ave, St. Paul 4, Minn.

ELECTRICAL EQUIPMENT

★ **DISTRIBUTION APPARATUS** — 196-page digest 54-500 presents complete data on transformers, voltage regulators, meters, instruments, capacitors, fuses, switches, circuit breakers, street lighting, etc. Photos, specifications. ★Request direct from local representative. Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

B11 **TEST STANDS**—Are units for testing magnetos, generators, alternators, hydraulic pumps, drives, etc. ¼ to 75-hp units, speeds to 15,000 rpm. 8-page bulletin 1748 gives charts, photos. U S Electrical Motors Inc, 304 E Slauson Ave, Los Angeles 11, Calif.

B12 **LIGHTING SPECIFICATIONS**—For industrial equipment, electrical contractors. 1952 NLM Specifications Book includes codes, curves, specifications, revisions from earlier editions. NLM Standards Institute, 918 W Madison, Chicago 6, Ill.

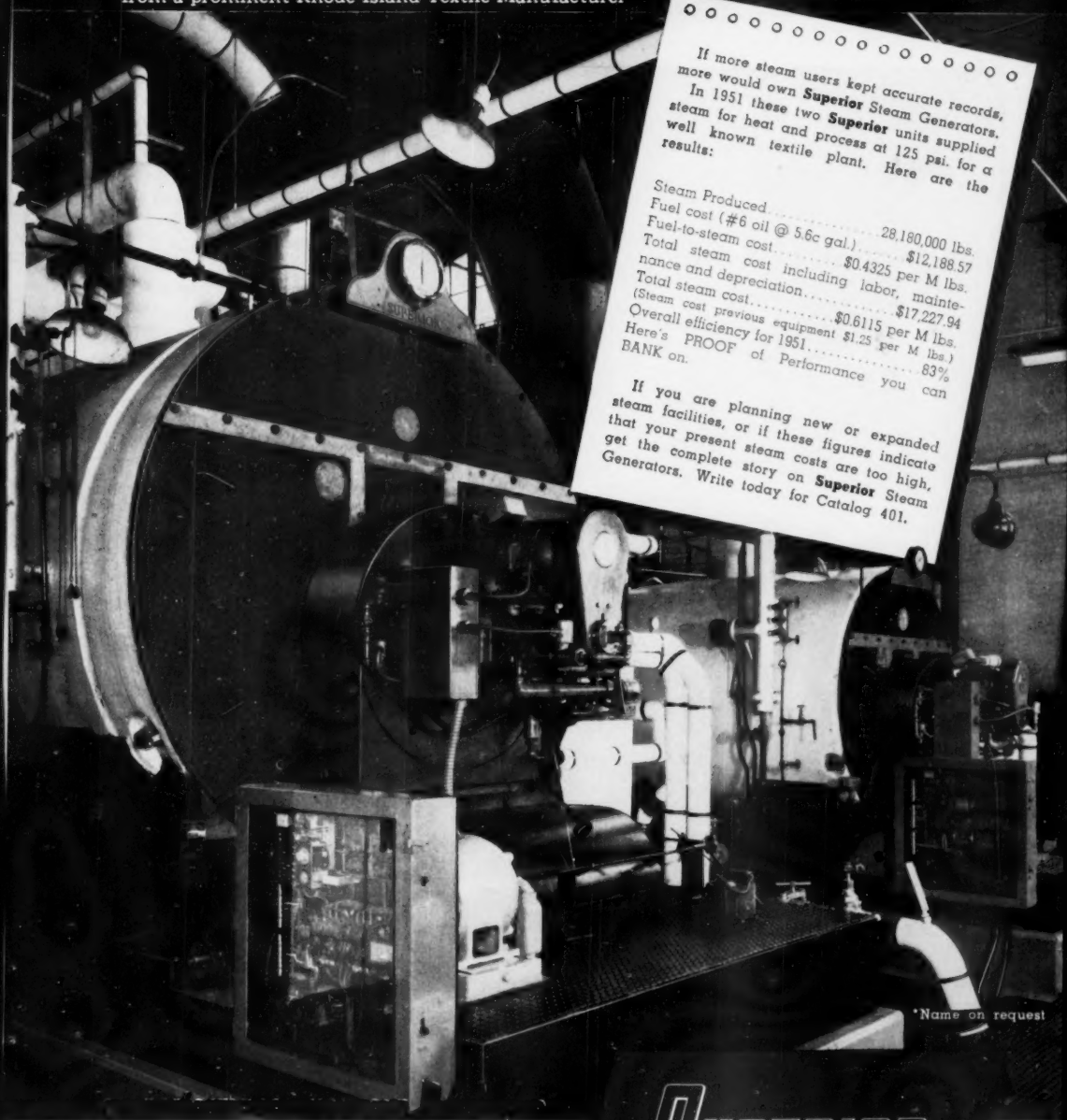
B13 **LIGHTING HANGERS**—Disconnecting and lowering fixtures and accessory items. 8-page bulletin TH-52 gives schematic layouts, descriptions for indoor and outdoor installations. Thompson Electric Co, 1111-93 Power Ave, Cleveland 14, Ohio.

(Continued on page 200)

accept no [illegible] of economy

LOOK at these [illegible] STEAM COSTS

from a prominent Rhode Island Textile Manufacturer *



If more steam users kept accurate records, more would own **Superior** Steam Generators. In 1951 these two **Superior** units supplied steam for heat and process at 125 psi. for a well known textile plant. Here are the results:

Steam Produced	28,180,000 lbs.
Fuel cost (#6 oil @ 5.6c gal.)	$12,188.57
Fuel-to-steam cost	$0.4325 per M lbs.
Total steam cost including labor, maintenance and depreciation	$17,227.94
Total steam cost	$0.6115 per M lbs.
(Steam cost previous equipment $1.25 per M lbs.)	
Overall efficiency for 1951	83%

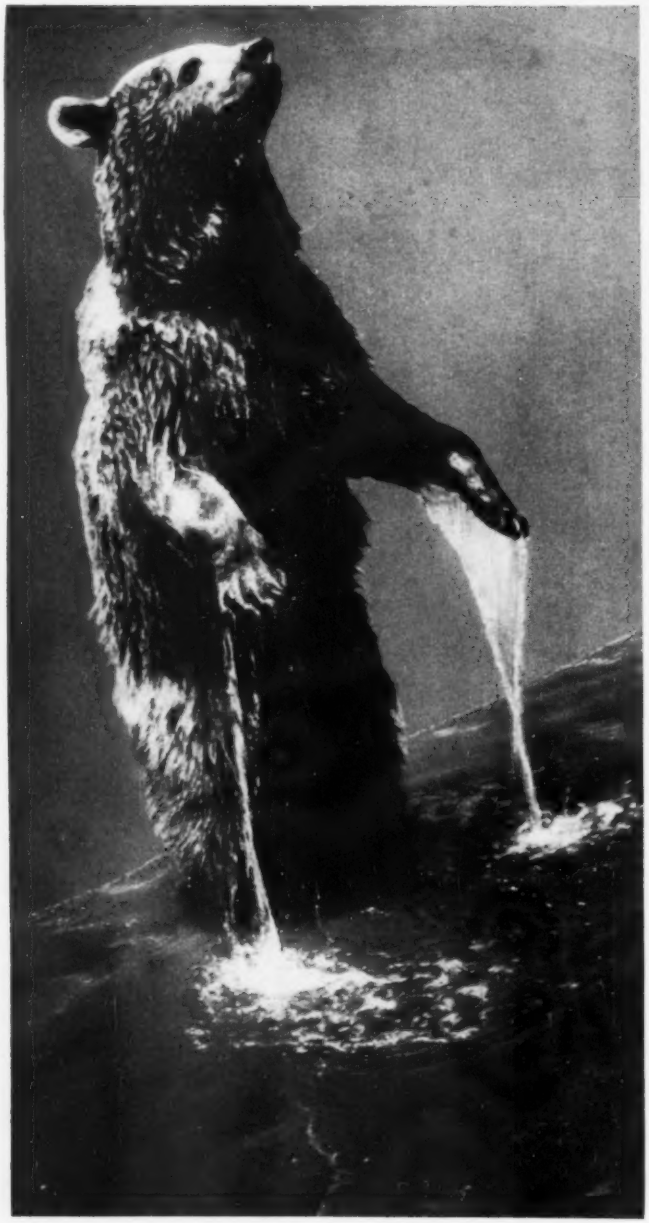
Here's PROOF of Performance you can BANK on.

If you are planning new or expanded steam facilities, or if these figures indicate that your present steam costs are too high, get the complete story on **Superior** Steam Generators. Write today for Catalog 401.

*Name on request

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 18, N.Y.

SUPERIOR
STEAM GENERATORS



I Must'a Opened the Wrong Valve

OH NO, NOT *again*, BRUNO! *That's the second time you flooded that machinery room this week. And we just got through drying out all those motors and putting them back into service this morning.*

Does this picture bring back unhappy memories to you readers? Sure it does. This kind of thing is repeated almost daily—in some plant or another around the country. The wrong valve is opened or closed. The wrong switch is thrown or pulled. Equipment isn't lubricated, or it's lubricated with the wrong oil. So, slowing down our power output goes on and on, like "Ole Man River."

So what? Just this: all these expensive boners can be slashed way down by using check-off sheets for starting up and shutting down equipment. Label all your valves and controls to make them foolproof. Then employ well trained, competent help. And I've found the more modern and automatic the plant, the more need for well rounded men to keep it running. That also means training each new man before turning him loose to gum up your expensive works.

Careful screening will find men who intend to make plant operation a career, men who take pride in their profession. With no licensing required of operating engineers in most of our states, it just doesn't pay to hire the first jack-of-all-trades who comes along and is willing to work for less.

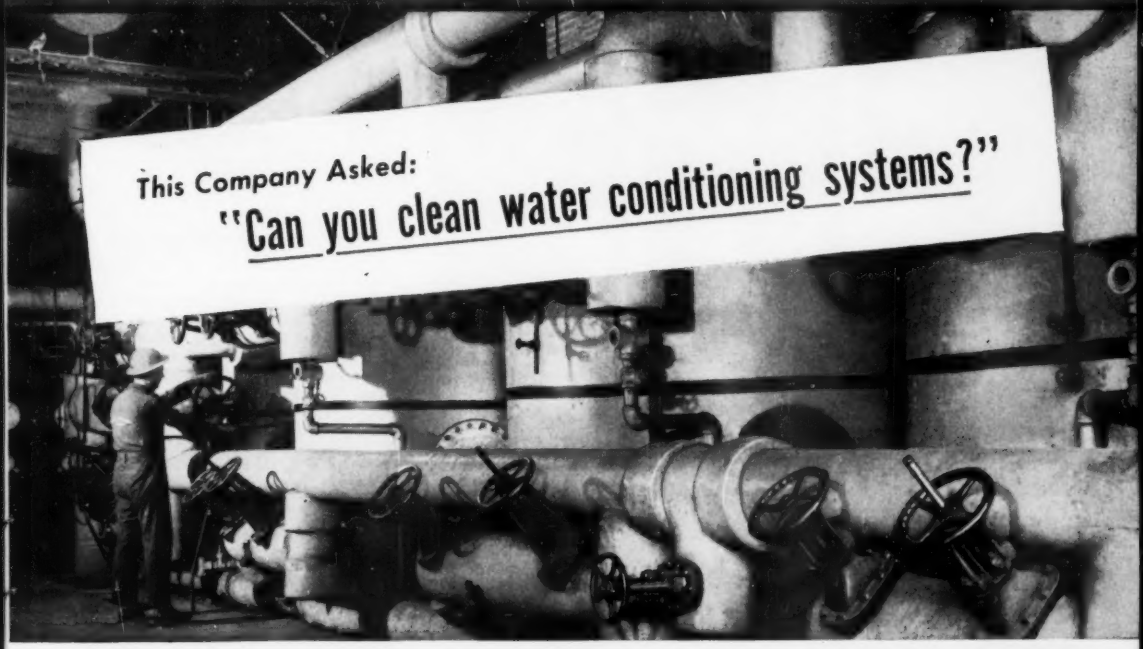
Mechanics of Bruno's caliber might cut down on the payroll but you'll surely pay through the nose before they are through with you.

George Edwards

Engineer

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



Dowell Service has cleaned many types of water supply equipment FAST!

If deposits are cutting production and profits in your plant . . . Dowell Service offers an effective remedy! For example, in water supply and water treating systems, deposits may accumulate in pipes, pumps and filters . . . impairing operating efficiency. Maintenance men in many industries rely on Dowell Service to clean operating equipment . . . *without dismantling and with a minimum of downtime!*

Experienced Dowell engineers do the job, using Dowell-designed, truck-mounted equipment. Liquid solvents designed to remove deposits quickly, efficiently and economically are applied according to the techniques demanded by the job: for example, by filling, spraying, jetting, cascading or vaporizing. Often equipment can be cleaned in operation.

Let Dowell Service *save you time and money* in your maintenance cleaning! Call the nearest Dowell office today for FREE consultation.

Recent Dowell jobs in Feedwater Systems

SCREEN FILTERS: In less than three hours, Dowell Service removed 90% of deposits from filters used to screen river water for a 48" strip mill.

WATER SOFTENER: Approximately 18 inches of hard calcium carbonate piled up in the bottom of a water softener's deaerating compartment. In less than one day, Dowell Service thoroughly cleaned compartment.

FILTER BEDS: The backwash rate on an anthracite filter was reduced to 75 gallons per minute by accumulated deposits. After Dowell Service, backwash rate was increased to an effective 385 gallons per minute.

ION EXCHANGE BEDS: Iron oxide clogged an ion exchange water softener. Before cleaning, two pumps were required to provide pressure for adequate back wash. After Dowell Service, one pump was sufficient.

FEEDWATER LINES: Before cleaning, it was necessary to use three 100 horsepower pumps to force water through clogged feedlines to a boiler house. Following Dowell Service, only one pump was required.

PUMP: Two high pressure feedwater pumps were nearly clogged with deposits. Dowell service completely cleaned them along with rest of the feedwater system.

WATER WELL: Before treatment, a water well produced only 108 gallons per minute with a 35' drawdown. After Dowell acidizing, water flow increased to 450 gallons per minute with a 27' drawdown.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

CALL

New York 20	Ft. Worth 2	Atlanta	Mt. Pleasant, Mich.
Boston 16	Chicago 4	Indianapolis	Hamilton, Ohio
Baltimore	St. Louis 8	Louisville	Charleston, W. Va.
Wilmington 99	Kansas City 8	Upper Montclair, N. J.	Salem, Illinois
Richmond 19	Wichita 2	Ardmore, Pa.	Beaumont, Texas
Jacksonville 2	Oklahoma City 2	Anniston, Alabama	Borger, Texas
Buffalo 2	Houston 2	Hattiesburg, Miss.	Midland, Texas
Cleveland 13	New Orleans 12	Lafayette, La.	Wichita Falls, Texas
Pittsburgh 19	Shreveport 69	Dearborn, Mich.	Hobbs, N. Mex.

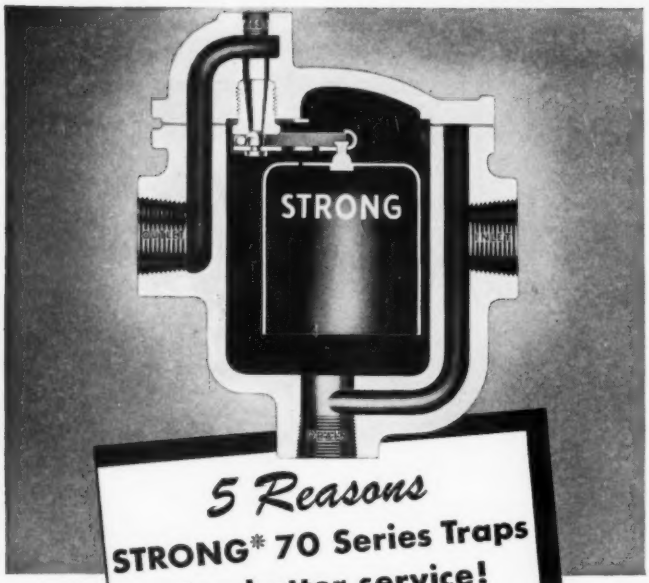
★ *Maintenance cleaning service for industrial heat exchange equipment.*

★ *Chemical services for oil, gas and water wells.*

DOWELL

A Service Subsidiary of

THE DOW CHEMICAL COMPANY



5 Reasons
STRONG* 70 Series Traps
give better service!

Look to these five reasons for long, trouble-free service in STRONG 70 Series Traps:

1. *Valve and seat guaranteed leakproof for one year—made of STRONG's patented, wear-resistant Anum-Metl;*
2. *Easy servicing—permitted by the renewable seat design, cover with all working parts easily removed without breaking pipe connections;*
3. *One piece bucket—stainless steel, no welds;*
4. *Turbulence avoided, choking minimized, 25% greater capacity—with STRONG's exclusive Hi-Cap orifice;*
5. *No dribbling, quick, full opening—high ratio leverage.*

STRONG *in-line* 70 Series Traps are available in sizes from ½" to 1", semi-steel construction. STRONG's "two-in-one" blast trap with integral thermal air vent is also available in the 70 Series (see cut below).

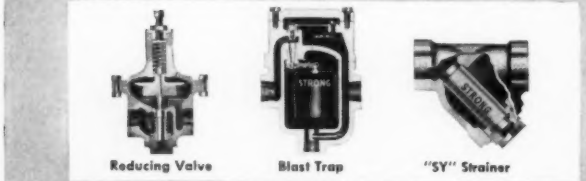
Catalog No. 68-P describes these traps in detail along with other STRONG traps. Write today.

*Trademark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY
1392 WEST 3rd Street
Cleveland 13, Ohio

† ANUM METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

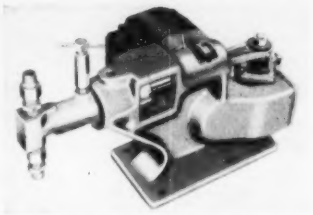


Reducing Valve | Blast Trap | "SY" Strainer

STRONG

More EQUIPMENT NEWS

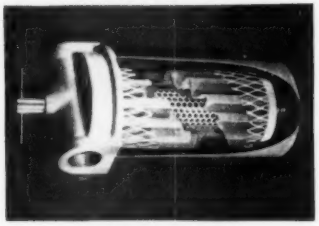
Begins on page 170



CONTROLLED VOLUME CHEMICAL METERING PUMP

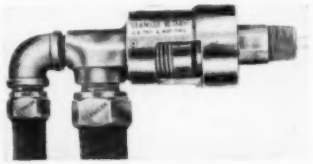
P916 • Model X-52 *Adjust-O-Feeder* provides accurate feeding of chemical solutions where low capacity and medium pressure will meet requirements. Standard model has adjustable capacity range from 1 to 10 gph, pressures up to 650 psig. A feeding range of from 0.5 to 5 gpm at same discharge pressure is also available. Unit is complete and self contained, weighs less than 100 lb. Bulletin 1105.
Proportioneers, Inc, 345 Harris Ave, Providence 1, R. I.

For more data on these items, use post cards, p179. Identify request with P and number.



WATER FILTER

P933 • Low pressure oil filter has now been adapted for filtering water. *Synclinal* sump-type filter has capacities from 5 to 100 gpm, line-type from 5 to 50 gpm; monel mesh sizes from coarse 30 to fine 200. Line type operates in any position and may be serviced without disturbing pipe connections. Both sump- and line-type models may be dissassembled, cleaned and reassembled on the spot by any workman.
Marvel Engineering Co, 627 W Jackson Blvd, Chicago 8, Ill.



ROTARY PRESSURE JOINT

P961 • Designed to convey liquids and gases from stationary pipe line to a revolving receptacle, its outstanding features are, (1) external screw adjustment for on-the-spot compensation of rotary seal wear,

HOW TO SIMPLIFY YOUR STORAGE

Now — one multi-purpose Grease will handle virtually all your Grease Requirements!

Reduced inventory . . . less chance for error in application . . . savings in maintenance. These are but three of the big benefits you get with Gargoyle Grease BRB No. 1.

This single, multi-purpose grease will provide correct lubrication for practically all normally loaded anti-friction and plain bearings in the average industrial plant. It resists leakage and "wash out," protects against rust and corrosion, lasts many times longer in anti-friction bearings than conventional greases.

Why use more than the one grease when one will do? Call your Socony-Vacuum representative.

Send for informative pamphlet about Gargoyle Grease BRB No. 1. Write to Socony-Vacuum Oil Company, Inc., 26 Broadway, New York 4, N. Y.

SOCONY-VACUUM

SOCONY-VACUUM

Correct Lubrication

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

NOW, AS ALWAYS

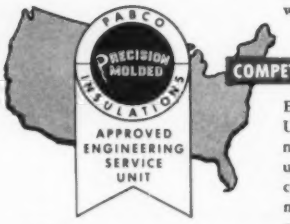
PABCO PRECISION MOLDED 85% MAGNESIA HEAT INSULATION

MEANS NATION-WIDE SERVICE

MODERN ENGINEERING demands precise standards of heat insulation performance. Pabco's *Precision Molded* 85% Magnesia combines the time-tested superiority of Magnesia with precision molding to give you a light weight insulation manufactured to very close tolerances.

LOCAL STOCKS

Pabco Engineering Service Units are strategically located throughout the United States and maintain adequate stocks of Pabco's *Precision Molded* 85% Magnesia Heat Insulation. Regardless of your location, Pabco Engineering Units give the service and materials you need when you need them.



COMPETENT INSULATION ENGINEERS

Each Pabco Approved Engineering Service Unit is staffed with competent insulation engineers and skilled mechanics. Between each unit and the Pabco factory there is a constant cooperative interchange of experience and methods, resulting in special benefits to every customer.

SERVICE EVERYWHERE

Pabco Engineering Service Units may be found in the classified section of the telephone book, or by writing to the factory. You can depend upon every Pabco Engineering Service Unit for the same high standards of materials, workmanship and methods of application. Get the complete facts on Pabco heat insulation and service now for your future needs.

THE DEPENDABLE STANDARD — "MODERNIZED"

quality

PABCO PRODUCTS INC.

Insulation Division

San Francisco 19 New York 16

Manufacturers of Heat Insulation

Since 1920

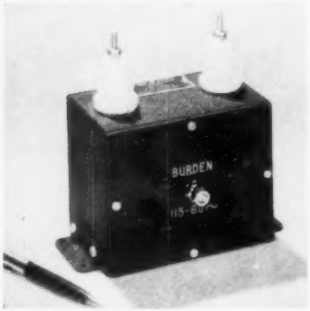
Pabco Engineering Service Units in all Principal Cities

More EQUIPMENT NEWS

Begins on page 170

(2) special-graphite self-aligning floating rotary seal, (3) pressure equalizing chamber to take strain off rotary seal. Standard Class 15 capacity: 150 psi, 350 rpm, 350 F; standard sizes from ½ to 1¼ in IPS. Available in syphon and single-flow types. More details in Bulletin 5500.

Seamlex Co, Inc, 4123 24th St, Long Island City, N.Y.



For more data on these items, use post cards, p179. Identify request with P and numbe

DC MEASURING REACTOR

P952 • Dc voltage-measuring reactor gives increased safety by insulating instrument circuit from power source.

Reactor is designed to minimize problem of injuring personnel or damaging equipment resulting from bringing leads directly from source to instrument panel. Developed for remote measurements up to 1200 v, the equipment consists of a saturable core reactor with a single dc winding, two ac windings, and proper range resistors. The dc winding has a saturating effect on core, and ac windings. Selenium bridge rectifier in ac circuit permits interpretation of average current.

Unit has an accuracy of ± 0.5% of full scale and operates on a power supply of 115 v, 60 cycles.

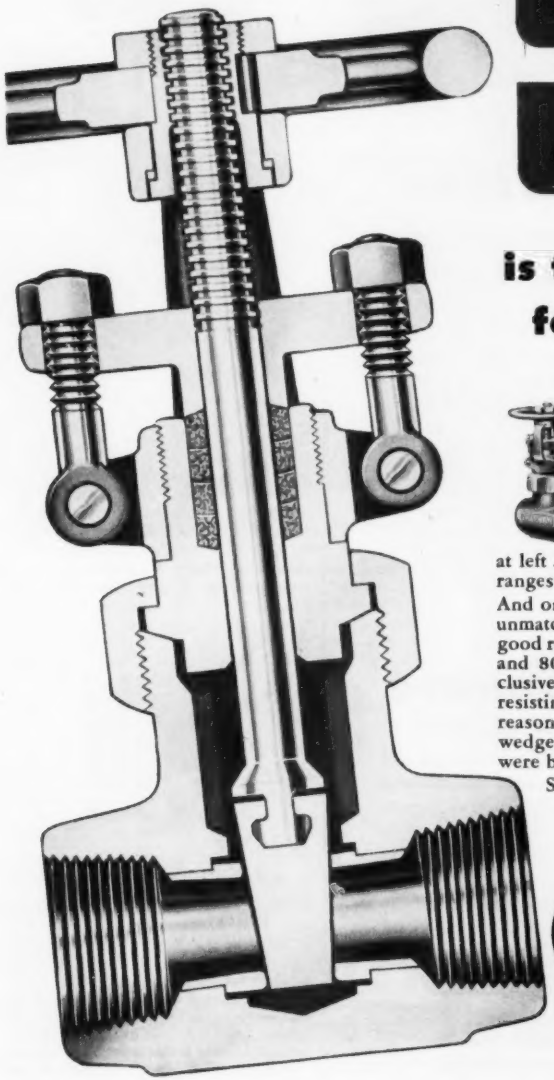
General Electric Co, Schenectady 5, N. Y.

DUAL TEMPERATURE PIPE INSULATION

P935 • Made of fibrous glass bonded with a thermosetting binder, this insulation is accurately preformed in easy-to-apply hemicylinders and segments that fit all standard pipe and tubing sizes. A vapor barrier, composed of laminations of asphalted kraft paper and aluminum foil adhered to the

You don't have to look it up...

CHAPMAN LIST 960



is the RIGHT NUMBER for any number of different jobs

No other small valve has as big a field of application as this Chapman List 960 Forged Steel Gate Valve. You can get it in sizes from ¼" to 2", with joints either gasketed or metal-to-metal . . . and in 2 types: Rising stem with yoke, as shown at left . . . or rising stem with inside screw. Pressure ranges from 2,000 lbs. at 100° F, to 380 lbs. at 1,000° F. And on *any* job, Chapman's List 960 shows the same unmatched ability to take it . . . and stay with it. One good reason is that hard faced Stainless steel seat rings and 800 Brinell hardening of gate faces by the exclusive Malcomizing Process, provide maximum wear-resisting and non-galling properties. And still another reason is that changes in design have made stem and wedge gate connections *50% stronger* than they ever were before.

So if you want the biggest savings you ever got from a small valve, *specify Chapman List 960.*

THE

CHAPMAN

VALVE MFG. CO.

INDIAN ORCHARD, MASS.

"Cultivated" Hides

THE FOUNDATION FOR LESS COSTLY, MORE PRODUCTIVE DELIVERY OF POWER

By means of expert "cultivation" *raw hides* of the finest quality are transformed into Rhoads Tannate Leather Belting. Through Rhoads exclusive tanning processes, the natural characteristics of leather are developed to a much greater degree. For instance, its strength is made stronger . . . and its physical grip on pulleys made glove-like. It's made to withstand shock and long hours of continuous operation. These qualities are built into Tannate by special "cultivation". They give Tannate belting higher capacity, longer life, than any ordinary oak belting. Write for Rhoads new Data File on the application of Tannate Leather Belting on short and long center drives. J. E. Rhoads & Sons, 35 N. Sixth St., Philadelphia 6, Pa.

Tannate®

IN ACTION

This chipper drive in a mid-western paper mill demands the high capacity of Tannate Leather Belting to absorb the intermittent, heavy shock loads . . . thus protecting motor and bearings.

250 YEARS PRODUCING FINE LEATHERS

J. E. RHOADS & SONS
PHILADELPHIA • NEW YORK
CHICAGO • ATLANTA

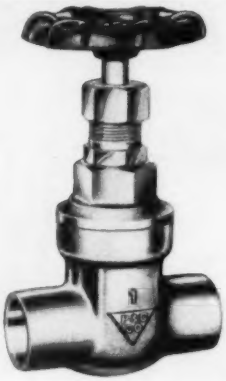
More EQUIPMENT NEWS

Begins on page 170

Fiberglas insulation with a bituminous adhesive, provides effective condensation control on cold lines passing through warmer temperatures. Insulation can be used for pipe lines operating at low temperatures or at alternate cycles of high and low temperatures.

Owens-Corning Fiberglas Corp, Toledo 1, Ohio

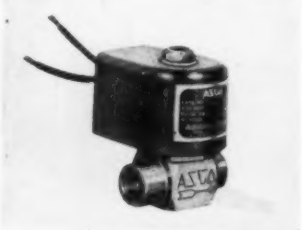
For more data on these items, use post cards, p179. Identify request with P and number.



GATE VALVE

P934 • No. 90 bronze gate valve is ideal for hot and cold water lines or low pressure steam—in plumbing, heating and air conditioning systems. It provides full, unobstructed service flow, has a sturdy, amply-sectioned body that will not distort; nor will its seat warp under soldering temperatures. For use with K, L and M copper tubing.

American Chain & Cable Co, Inc, Reading-Pratt & Cady Div, Reading, Pa.



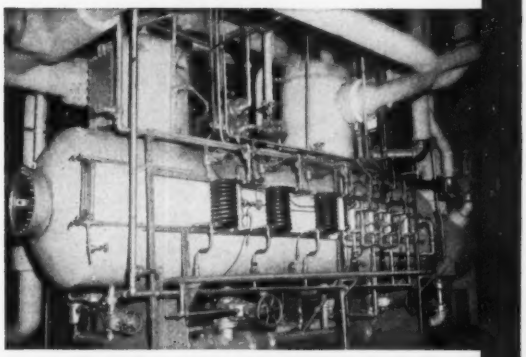
SOLENOID SHUT-OFF VALVE

P962 • Midget solenoid shut-off valve with time delay mechanism to hold back flow of liquid or gas through valve about 5½ seconds after solenoid is energized. Valve is suited for oil burner applications where you want instant combustion. Time delay mechanism holds back oil flow until a full stream of air, sufficient to make a perfect combustible mix is flowing through burner.

Valve has ⅛ in. pipe connection and full

Do you need proved power plant equipment?
— let this ALCO check list help you

1 Closed Type Feedwater Heaters
2 Evaporator Condensers
3 Condensate Coolers
4 Jacket Water Coolers
5 Lubricating Oil Coolers
6 Evaporators
7 Oil Tank Suction Heaters
8 Fuel Oil Heaters
9 Blowdown Exchangers
10 Aircooled Heat Exchangers
11 Prefabricated Pipe
12 Propane Storage Tanks
13 Large Diameter Water Lines
14 Penstocks



For Example—ALCO Flex-Tube Evaporators have a positive-acting, thermomechanical descaling action.

Making use of this principle, engineers designed a patented arrangement of struts, tension bars and split support plates. The tubes bend or flex when heat is applied to the coil side. When cold water is sprayed over the tube bundle, the tubes contract, and scale cracks off and is flushed away through blowdown openings.

ALCO

ALCO PRODUCTS DIVISION
AMERICAN LOCOMOTIVE COMPANY
Dunkirk, N. Y.

In step with tomorrow—**Alco Aircoolers, Heat Exchangers, Evaporators, Feedwater Heaters, Pressure Vessels, Pipe**

Other important features include:

HEATING ELEMENT SITUATED IN LOWER HALF OF SHELL, provides maximum disengaging area.

SHELL SIZE GIVES AMPLE SPACE under heating element for scale removal.

SMALL SEPARATE REMOVABLE CHANNEL AND COVER eases job of maintenance men.

TWO OR MORE BLOWDOWN CONNECTIONS of large diameter for effective flushing.

UNIFORM COMPRESSION BOLTING assures tight joints but permits quick convenient access to key points for inspection and maintenance.

For more details about ALCO Flex-Tube Evaporators or your other power plant equipment needs, mail the coupon or call the nearest ALCO sales engineer at Beaumont, Chicago, Dunkirk, Houston, Kansas City, Los Angeles, New York or Tulsa.

ALCO PRODUCTS DIVISION
American Locomotive Company
Schenectady, New York

P

Gentlemen:
Please send me information on the following items:

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12__ 13__ 14__

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____

Masoneilan No. 11

Pressure Reducing Valve

Sets new standard for Accurate regulation!

This better-than-ever Masoneilan No. 11 holds reduced steam pressure settings with complete accuracy and dependability. Super-finished integral pilot valve, and main valve respond instantly to slightest variations in reduced pressure — prevent sticking and corrosion.

Easier to service, too, all parts may be removed and cleaned with the valve in the line. Maintenance consists of *little more than keeping the valve parts clean.*

Initial pressures up to 250 lbs. reduced to any desired pressure between 10 and 90 lbs. or 75 and 225 lbs. Sizes ½" to 2" with bronze body. (Also available in iron and steel.)

A HIGH Quality Coefficient PRODUCT

Call your Mason-Neilan Industrial Distributor for fast, dependable service.

MASONEILAN

Mason-Neilan Regulator Company

1186 ADAMS STREET, BOSTON 24, MASS., U.S.A.

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More EQUIPMENT NEWS

Begins on page 170

1/16 in. port for pressures up to 150 psi with 15 gph flow. Also available is a similar valve with ⅛ in. pipe connection, full ⅛ in. port for pressures up to 125 psi, 40 gph flow, and with a time delay of approximately 6½ seconds. Standard continuous duty coil for 115 v, 60 cycles. Brass or stainless steel body; stainless steel operating parts. Soft composition disc assures tight shut-off.

Automatic Switch Co, Orange, N.J.

For more data on these items, use post cards, p179. Identify request with P and number.

PRIMER FOR NON-SELF-PRIMING PUMPS

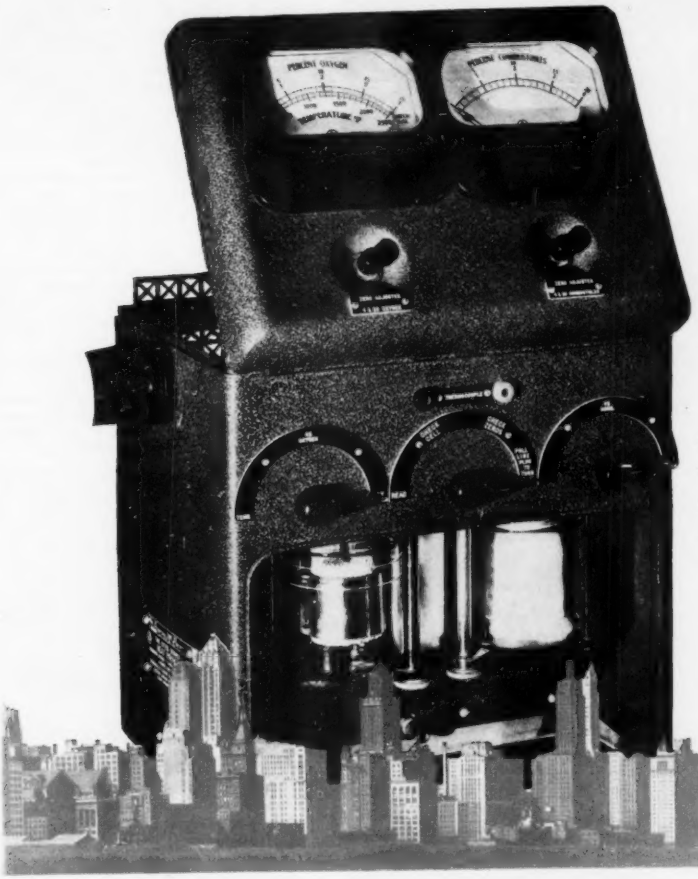
P928 • Priming inductor is designed to prime pumping systems where pump is set above water level. Unit requires only a clear liquid service pipe, and is coupled to entrance pipe of pumping unit. No valves are needed in either entrance or discharge pipe, and priming is complete in a few seconds. 13 sizes fit entrance pipes from 1½ to 18 in.

Nagle Pumps, Inc, 1249 Center Ave, Chicago Heights, Ill.

LIQUID-LEVEL CONTROL

P945 • Electrical system, called *Thermasul* is used for sewage and water level control and indication. System can be used in wet wells, sumps, reservoirs, elevated tanks, standpipes, etc. It will control pump motors, pump motor speeds, and supervisory and alarm circuits.

Thermasul element consists of a temperature-sensitive, sintered-sulphide compound around which is wound a resistance heater. Whole assembly is hermetically sealed in a stainless-steel tube. In air, resistance of



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TO A LEADING CHEMICAL HOUSE,
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AND A MEAT PACKER . . .

Heat Prover SERVES 62 DIFFERENT COMPANIES IN THE GREAT CHICAGO INDUSTRIAL AREA!

The Cities Service Heat Prover is graphically proving its worth to all kinds of industry in the Chicago area and elsewhere throughout the country.

62 different companies, producing everything from steel to beef, have found the Heat Prover an important aid to increased production and big dollar economy.

WHEREVER A FURNACE OPERATION IS INVOLVED, Heat Prover can help increase productivity by providing:

1. **Rapid, continuous sampling.**
2. **Simultaneous reading of oxygen and combustibles.**
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REMEMBER: Heat Prover is not an instrument you buy but a service we supply. Contact the Cities Service office in your area and learn how Heat Prover can serve you . . . or write CITIES SERVICE OIL COMPANY, Dept. I-22, Sixty Wall Tower, New York City 5.

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QUALITY PETROLEUM PRODUCTS

TO OWNERS OF...

- AMES STEAM ENGINES
- ELLIOTT (Ridgway) STEAM ENGINES
- CHUSE STEAM ENGINES

By individual arrangements with the manufacturers of the discontinued Ames, Elliott (Ridgway), and Chuse Steam Engines, Skinner Engine Company has been made the exclusive supplier of parts and service for their engines.

Owners are assured of the same prompt attention and expert service extended to owners of Skinner Steam Engines. Requests for inspection, parts, or service should be addressed to:

SKINNER ENGINE COMPANY
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For Over 80 Years, Doing One Thing Well—Building Steam Engines
SKINNER ENGINE COMPANY, ERIE, PA.

More EQUIPMENT NEWS

Begins on page 170

element is low because heater keeps level detector about 280 C above ambient air temperature. When detector is immersed in liquid, heat is conducted away and resistance of element jumps up rapidly, operating a small, remotely-located relay.

Element acts as a switch, opening and closing relay with presence or absence of liquid. Relay, in turn, can be used to control pump motors, and circuits for alarm, supervisory, and control equipment.

Straight or hooked probes are available; latter for use in low-level detection. Detector lengths range from 1 to 10 ft, and an additional 10-ft length of neoprene-covered cable is included.

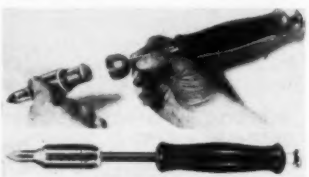
General Electric Co, Schenectady 5, N. Y.

For more data on these items, use post cards, p179. Identify request with P and number.

NON-ACID FLUX WITH WETTING ACTION

P907 • *Wetoil* non-acid flux can be used for soldering copper, brass, steel, terneplate, etc. It is a fast scavenger at low heat, will withstand a wide temperature range without oxidizing, does not fume and can be used with either torch or soldering iron. Flux contains alkaline buffers that serve two purposes: (1) They raise pH making flux more stable when not in use. (2) Residue left after soldering is largely neutralized, thus protecting metallic bond from corrosive flux attack. *Wetoil* flux residue is also soluble in water.

Farrelloy Co, 1245 N 26th St, Philadelphia, Pa.



SOLDERING IRON

P953 • Requiring no electric current or external heat of any kind, the *Quik-Shot* soldering iron utilizes a chemical cartridge that heats iron to working temperature in 10 seconds. Iron is held at an average soldering temperature of 800 F for seven minutes. Cartridge is ignited by impact of

DRAW A BEAD ON BOILER CARRYOVER

CARRYOVER refers to the entrainment of boiler water in the steam from any source, especially when it is due to foaming, priming or other causes. No matter what "IT" is called, anything other than dry steam going over from the boiler may lead to difficulties!

Use DREW POWER CHEMICALS

Almost all suspended and soluble materials in your boiler water system contribute to Carryover. They may lead to expensive trouble in boiler, steam and condensate lines and equipment and processes using steam. It's the duty of every good water treatment company to recognize and solve this problem.

Draw a bead on Carryover! Call the Drew engineer. The water samples and operating data that he obtains in your plant will be thoroughly analyzed in the Drew laboratories. You'll be given specific recommendations for corrective and preventive treatment . . . involving the use of Organics or Anti-Foams where necessary. And you'll receive continuous and frequent service, too!

Thorough investigation, proper treatment and frequent service have made Drew one of America's fastest growing water treatment companies. Consult the nearest Drew engineer, or write for information.

Power Chemicals Division

E. F. DREW & CO., INC.

15 East 26th Street, New York 10, N. Y.

SAN FRANCISCO CHICAGO PHILADELPHIA BOSTON DALLAS
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Service throughout the United States, Canada and South America

DREW PRODUCTS

NEW

KENNEDY booklet to help you specify A.W.W.A. valves

The new KENNEDY BULLETIN 106 gives you the *complete* story on KENNEDY A.W.W.A. Gate Valves. It gives detailed specifications . . . lists the wide range of types, sizes, controls, accessories, and connections and gearing arrangements available. It's packed with important facts you need to know when ordering or specifying A.W.W.A. valves. It provides valuable reference material for your permanent file.

WRITE TODAY FOR YOUR COPY OF BULLETIN 106!

THE COMPLETE KENNEDY LINE also includes KENNEDY SAFETOP and STANDARD Fire Hydrants. The KENNEDY SAFETOP is an easy-to-repair, two-piece breakable hydrant for use where heavy traffic causes constant risk of collision damage. The KENNEDY STANDARD is a sturdy one-piece hydrant designed for dependable service in less hazardous traffic locations. Both are non-flooding compression type.

WRITE FOR BULLETINS 61 AND 105.

THE **KENNEDY**
VALVE MFG. CO. • ELMIRA, N.Y.
Est. 1877

VALVES • PIPE FITTINGS • FIRE HYDRANTS

More EQUIPMENT NEWS

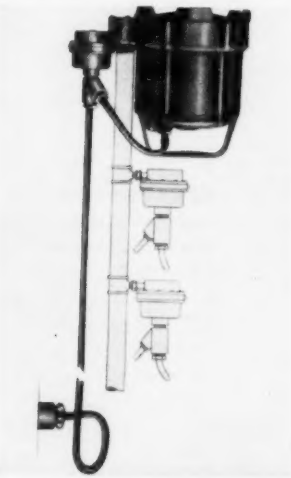
Begins on page 170

a spring rod that is pulled out and released at back of handle.

Iron is adapted to all kinds of soldering work where line power is neither available nor convenient.

Kemode Mfg Co, Inc, 161 W 18th St, New York 11, N. Y.

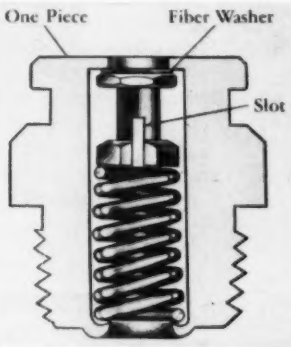
For more data on these items, use post cards, p179. Identify request with P and number.



PUMP AND CONTROL

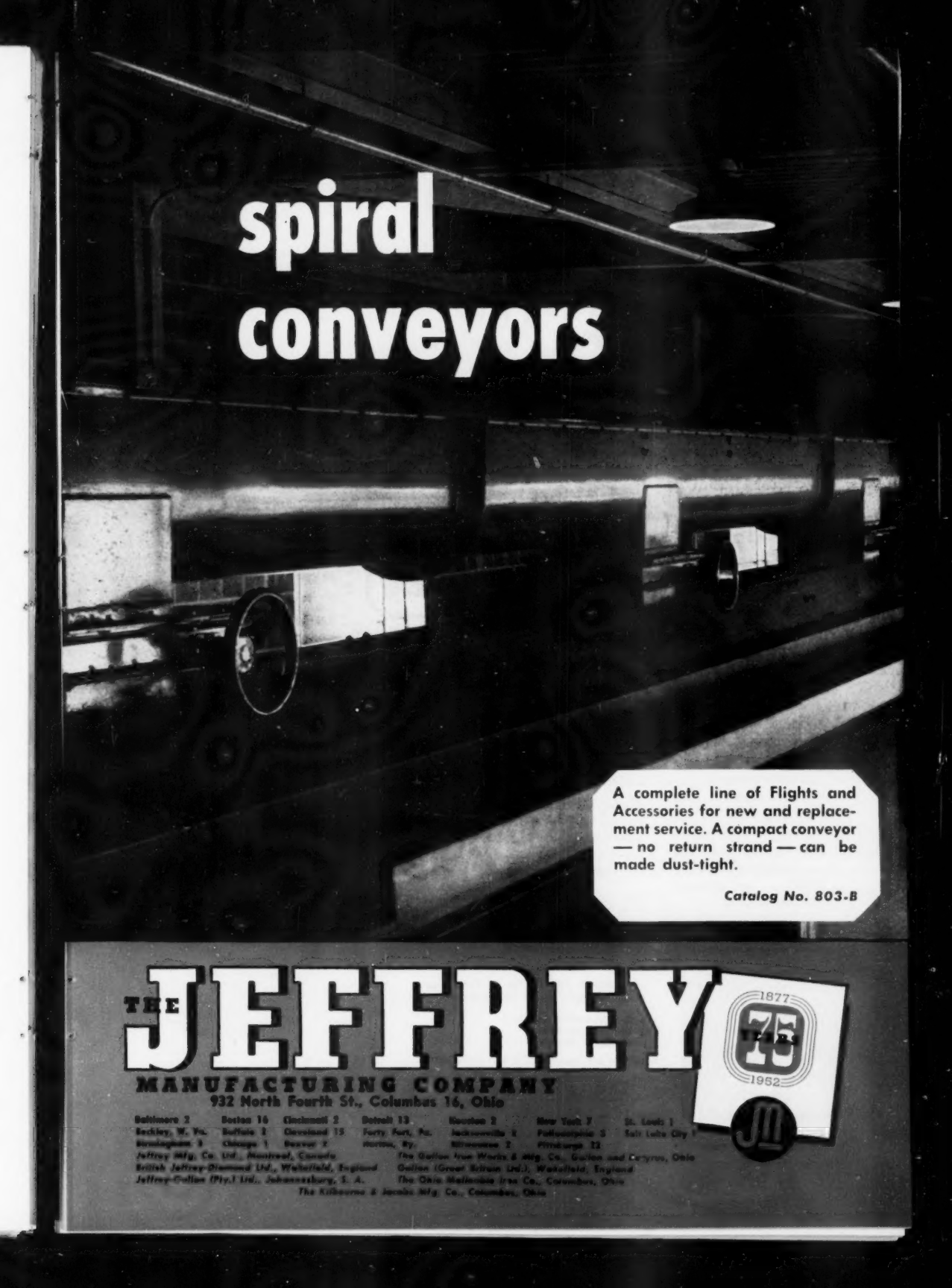
P927 • Precision, automatic control of water level at which sump and circulating pumps will turn on is offered with *Kenco* switch and submersible *Kenco* pump. Submersible switch has no exposed electrodes or floats to corrode or stick. Pumps operate at any practical depth and are completely waterproof. Capacities up to 3300 gph at 10 ft head are available.

Kenco, Inc, 1125 North Ridge Rd, Lorain, Ohio



BUTTONHEAD GREASE FITTING

P910 • New giant buttonhead grease fitting with one-piece construction prevents


spiral
conveyors
A complete line of Flights and Accessories for new and replacement service. A compact conveyor — no return strand — can be made dust-tight.
Catalog No. 803-B
THE JEFFREY MANUFACTURING COMPANY
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Jeffrey Mfg. Co. Ltd., Montreal, Canada
British Jeffrey-Diamond Ltd., Wakefield, England
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Galion Iron Works & Mfg. Co., Galion and Canton, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio
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When You Think of

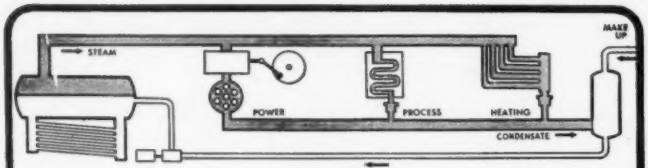
CORROSION PROTECTION for your STEAM SYSTEM

Think of

CORAVOL

(The Original* AMINE PROCESS)

Because CORAVOL Circulates to Control Corrosion



The CORAVOL ZONE—indicated by the shaded area in the diagram—includes every part of a steam system not accessible to boiler feed water treatment. It includes the boiler above the water line, steam lines, condensate return lines, radiators, valves, traps and equipment. This zone can now be reached and protected against rust and corrosive action—by CORAVOL.

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE which provides special chemical formulas for . . . boiler feed water . . . foam prevention . . . hot water supply . . . refrigerating brine . . . cooling and condenser water . . . rapid scale removal . . . coagulation . . . algae control . . . fuel oil supply . . . soot removal.

CORAVOL circulating throughout your steam system protects it from corrosive attack. **CORAVOL** saves costly pipe repairs and replacements—maintenance labor—hours and days of shutdown loss. **CORAVOL** cleans out clogging rust deposits, improving heat transfer, restoring original capacity of lines and efficiency of valves and traps.

CORAVOL, the original* amine process, has the flexibility that lets it conform to each individual need. The **CORAVOL** you will use is formulated to do the best protective job under your own plant conditions.

*The use of **CORAVOL** in steam systems is covered by U. S. Patent No. 2053024. The Western Chemical Co., owner of this patent, grants licenses under which volatile AMINES purchased from other sources may be used in steam systems upon payment of royalty to Western Chemical Co.

Chemical Water Treatment

WESTERN CHEMICAL COMPANY

713 Washington Street
Kansas City 6, Missouri

MAIL COUPON TODAY for
Complete Data about the CORAVOL Process

Western Chemical Company,
713 Washington Street,
Kansas City 6, Missouri

Send me full information about CORAVOL.

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CITY_____ ZONE_____

STATE_____

More EQUIPMENT NEWS

Begins on page 170

leakage possible with the conventional two-piece design that can separate under extreme pressure or jolting. Also featured is a strong, steel inner-spring that combines with a fiber sealing washer to prevent grease leak-back. Buttonhead fitting comes in all regular sizes.

Universal Lubricating Systems, Inc, 791 Allegheny Ave, Oakmont, Pa.

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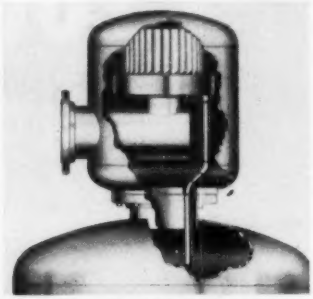
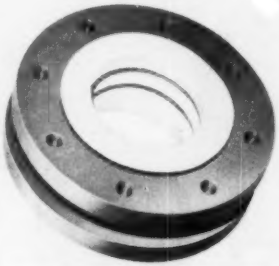


INTERNAL DOWNFLOW PURIFIER

P930 • Dirt, moisture, riser discharge and solids are removed before passing on to distribution piping by this new internal downflow purifier. It is installed in an auxiliary tank immediately above evaporators, packed towers, deodorizers, stills, bubble-cap towers and inside steam drums, flash tanks, receivers and other vessels. *Hi-eF* purifiers are guaranteed to boiler industry to deliver vapor with 1.0 ppm or less of total solids. In other applications they remove 99% of all entrainment.

Multi-stage centrifugal element engages entrainment-laden vapor at inlet, eliminates it in three carefully controlled stages. There is no critical pressure drop through unit. Bulletin 400.

The V D Anderson Co, 1935 W 96th St, Cleveland 2, Ohio



CHEMICAL-RESISTANT FLEXIBLE COUPLING

P920 • *Chemiseal* flexible coupling is composed of a bellows with only 2 convolutions, assembled with flanges of either cast iron, aluminum or special metals, and embodying integral gaskets. Made of *Teflon*, these couplings are completely imper-

The Megger®

Insulation Resistance Tester

...its own best salesman

Nearly every electrical man knows or has used the MEGGER Insulation Resistance Tester.

The Megger Tester has, over the years, become an integral part of electrical operations everywhere. Through its inherent qualities of ruggedness, accuracy, and dependability it has earned for itself the enviable distinction of being the most widely accepted device for measuring electrical resistance.

Right in stride with today's pace of production, the Megger Insulation and Resistance Tester is demonstrating, in severe industrial service, that it is the most practical and economical means for making insulation resistance tests within the ranges of the available Megger instruments.

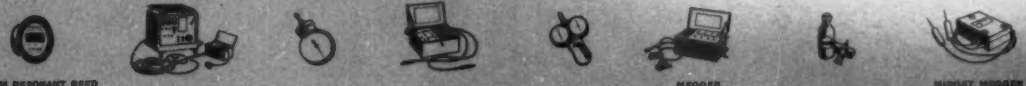
MEET THE WHOLE FAMILY

On the next page we have illustrated and briefly described the instruments which now comprise the Megger Family of Insulation and Resistance Test Sets—all represent variations of and improvements on the original Megger Tester.

(over)

JAMES G. BIDDLE CO.

Electrical & Scientific Instruments • 1316 Arch Street • Philadelphia 7, Pennsylvania



FRAHM RESONANT REED FREQUENCY METERS & TACHOMETERS

BIDDLE IMPULSE CABLE FAULT LOCATOR

JAGABI TACHOMETERS & SPEED INDICATORS

"TTR" TRANSFORMER TURN RATIO TEST SET

JAGABI TACHOSCOPE

MEGGER LOW RESISTANCE OHMMETER

APIEZON OILS • GREASES • WAXES

MIDGET MEGGER CIRCUIT-TESTING OHMMETER

The Famous Family of *Megger*® Insulation Testers

One of the outstanding characteristics of all types of Megger instruments is quality of a high order. The performance and endurance records which these instruments have achieved are difficult, if not impossible, to match in any type of portable testing device. For insulation resistance measurements Megger instruments are *the recognized standard*. Today more than ever they are "indispensable tools" for electrical preventive maintenance and other electrical resistance testing in the field, plant, or laboratory.

Such developments as the rectifier-operated and dual-operated (hand or rectifier) sets perform repetitive tests more conveniently, more effectively, than can be done by hand cranking. Conversely there is no substitute for the hand generator in the field and for emergencies where supply current is unavailable.

HEAVY-DUTY TYPE MEGGER INSULATION TESTERS

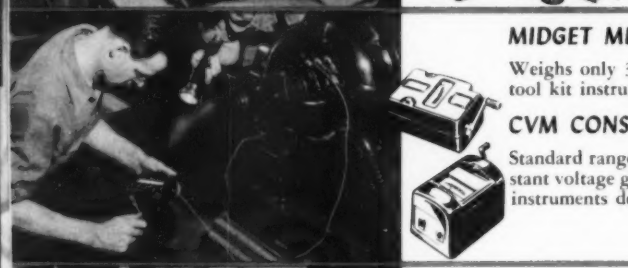
Standardized ratings up to 50,000 megohms and 2,500 volts d-c with d-c generator for either hand or motor operation. Special ranges up to 100,000 megohms and 5,000 volts d-c.

Bulletin 21-20-IN.

MEG TYPE OF MEGGER INSULATION TESTERS

These light weight, easy-to-use instruments are available with ranges up to 2000 megohms, 1,000 volts d-c. Optional accessory features include ohm scales 0 to 10,000 ohms and ratio and discharge switches. *Bulletin 21-45-IN.*

RECTIFIER-OPERATED and DUAL-OPERATED MODELS are available in the same ranges for repetitive production or inspection tests. Complete details in *Bulletin 21-46-IN.*



MIDGET MEGGER INSULATION TESTER

Weighs only 3 pounds and is completely self-contained. A handy tool kit instrument; ratings up to 50 megohms, 500 volts d-c.

CVM CONSTANT-VOLTAGE TYPE MEGGER TESTER

Standard ranges up to 50 megohms, 500 volts d-c, with built-in constant voltage generator; ohm scale and selector switch optional. Both instruments described in *Bulletin 21-85-IN.*

BRIDGE-MEG INSULATION *and* RESISTANCE TEST SET

A Wheatstone Bridge and the Meg Type of Insulation Tester combined in one instrument which performs practically every electrical resistance measurement from a fraction of an ohm up to 1000 megohms. The addition of the Varley Loop feature is optional. For versatility and convenience this instrument is unsurpassed.

Ask for *Bulletin 21-60-IN.*

James G. Biddle Co.

Electrical & Scientific Instruments

1316 Arch Street • Philadelphia 7, Pa.

"Tycol Aturbrio resists heat and sludging... turbines operate for years without shutdown"

Correct! Tycol Aturbrio Oils resist emulsification, foaming and deterioration even when turbines operate continuously. Oiling systems stay clean longer—uninterrupted service is assured.

Tycol Aturbrio Oils are "double inhibited" to give utmost rust and oxidation resistance. They keep costs down... hold wear to a minimum.

For further information, get in touch with your nearby Tide Water Associated office. Write or wire today.

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Tulsa • Cleveland • San Francisco

TIDE WATER ASSOCIATED OIL COMPANY

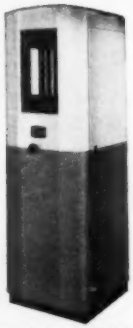
17 BATTERY PLACE, NEW YORK 4, N. Y.

SEND FOR A FREE COPY OF "TIDE WATER ASSOCIATED LUBRICANIA"

3 GUARDIANS FOR YOUR CONDENSERS...

1 Model HCVS (up to 6000 lbs./day)
Bulletin 840-J8

2 Model DVSX (up to 400 lbs./day)
Bulletin 840-F2A



3 Model CVS (up to 2000 lbs./day)
Bulletin 840-F1

These are the three volumetric solution-feed BUILDERS Visible Flow CHLORINIZERS. They're safe, simple, sure — the ideal chlorine gas feeders for chlorinating cooling water to eliminate slime in surface condensers and heat exchangers.

Chlorinizers are easy to install, easy to operate, easy to understand and service. Chlorinizers incorporate a unique Tantalum diaphragm control valve, the only control mechanism which permits changing from manual operation to automatic-proportional control, program control, or multiple-dosage operation right in the field. Capacity changes are equally easy to make due to the sound engineering and simple construction of Builders Chlorinizers.

May we show you how Builders Chlorinizers — by combatting slime in cooling water — can increase the efficiency of your plant operations? For descriptive Bulletins and complete information, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 354 Harris Ave., Providence 1, Rhode Island.

BUILDERS PROVIDENCE *Instruments*

More EQUIPMENT NEWS

Begins on page 170

vious to all chemicals except molten sodium and fluorine. They are suitable for connection to any major manufacturer's flanged-end piping.

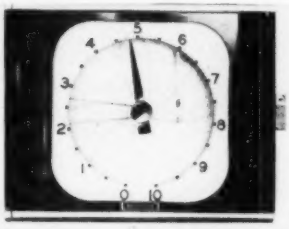
United States Gasket Co, Fluorocarbon Products Div, Camden, N. J.

For more data on these items, use post cards, p179. Identify request with P and number.

ALUMINUM-ASBESTOS ROOF COATING

P912 • *Asbestolite* coating is said to lower interior building temperature 15 to 20 F and permanently prevent roof deterioration. It is made of first quality aluminum flakes and high grade asphalt and asbestos suspended in a waterproof oil vehicle. The doubly-pigmented aluminum flakes "leaf" over the top of the asphalt and asbestos, forming an attractive, firm, metallic shield that reflects hot sun rays, seals out moisture and is impervious to rust, corrosion and fumes. *Asbestolite* is highly fire retardent and can be applied to any type roof.

The Monroe Co, Inc, 10703 Quebec Ave, Cleveland 6, Ohio



ROUND-CHART RECORDER

P946 • Round-chart *Dynamaster* models are accurate, high-speed, continuous-balance, null-type electronic instruments. They can be used to measure any variable that can be translated into an electrical quantity such as dc current, dc voltage, capacitance, or resistance. Typical sensing elements that can be used include thermocouples, radiation detecting units, resistance thermometer bulbs, pH amplifiers, tachometer magnets, strain gages, smoke density detectors, thermal converters for power measurements, beta ray gages, etc.

Measured variable is simultaneously recorded on a 12-in. diameter chart and indicated on a large circular scale that is legible at a distance. Full-scale pen travel

KEEP THE DIRT *out!*

with **SARCO**

PIPE LINE STRAINERS

Unretouched photograph of the screen of a Sarco Strainer, exactly as found, after brief service in a pipeline. Brimful of scale, rust and pipe dope.

The most complete line

available anywhere . . .

As manufacturers for more than 30 years of steam traps, heating specialties and temperature regulators, we have long been keenly aware of the necessity of protecting such mechanisms from damage by foreign matter in pipe lines carrying condensate, steam, air, gas, water, brine, ammonia, oil and other fluids.

Strainers quickly pay for themselves by preventing costly shutdowns and heavy repair bills.

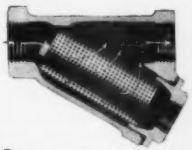
Sarco strainers have large capacities and offer minimum resistance to flow. They can be had in sizes from ¼" to 10" and larger, for all commercial pressures.

Bodies are of cast iron, semi-steel, cast steel, bronze or cast molybdenum steel. Screens are made of various metals with perforations as required.

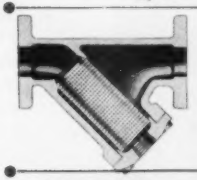
Furnished with screwed, flanged, socket weld and sil-braze connections.

Catalog 1200-4 free on request.

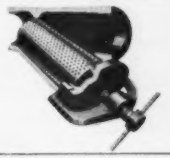
SARCO [redacted]
improves product quality and output



Sarco type SB and SBH strainers with screwed connections. Bodies of cast iron or bronze semi-steel or cast steel. Screens of brass, phosphor bronze, mild steel, stainless steel, or monel. Sizes ¼" to 6". For any commercial pressure.



Sarco Type D Strainers with flanged ends. Bodies cast iron standard to 125 psi, or extra heavy to 250 psi. Sizes 2" to 10".



Sarco Type SB Yoke style strainer, for low pressure fluids, such as fuel oil. Standard on many oil delivery trucks. Screen instantly removable for cleaning. Cast iron body and cap, screens as desired. Sizes 2" to 3".

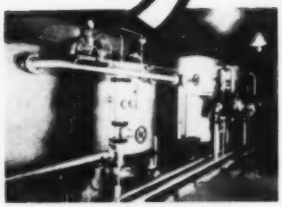
For pressures to 600 psi —Sarco Strainers built to meet Navy specifications. Sizes ¼" to 8", with screwed, sil-braze, socket weld or flanged connections. Bodies of cast valve bronze, cast steel, or cast carbon molybdenum steel.

Sarco Type SRS Scraper Strainer, hand-operated or motor driven, sizes ¾" to 8". Screen is scraped clean without interrupting flow or exposing the product to air contamination.

SARCO COMPANY, INC. ● Empire State Bldg., New York 1, N. Y.
REPRESENTED IN PRINCIPAL CITIES • SARCO CANADA, LTD., TORONTO 8, ONT.

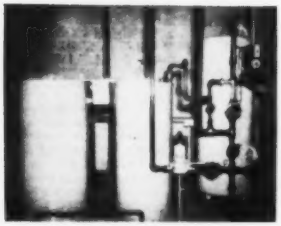
409

Layne WATER CONDITIONING

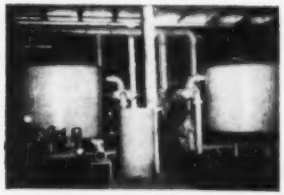


Iron Removal and Zeolite Water Softener

Demineralizer



Industrial Water Softener



Iron Removal by Pressure Aeration

For BOILER FEED and COOLING WATER

INDUSTRIAL PROCESS WATER

FOOD and PROCESS INDUSTRIES

MUNICIPAL WATER SUPPLY

General Filter Company's technical knowledge and experience are back of the design, construction and installation of water conditioning equipment for all types of industrial and municipal requirements in any part of the world.

Facilities are such as to enable General Filter to produce any volume of water conditioning equipment guaranteed to assure ample supplies of high quality water. Service includes instructing plant personnel in operation and supervision of completed installation until it has been placed in successful operation.

General Filter is associated with the Layne and Bowler, Inc. and its affiliated local companies throughout the world. Such a combination of facilities and talent brings to industry outstanding accomplishments in water conditions and assurance that your most exacting needs can and will be most effectively and economically met.

Ask for technical bulletins available on all phases of water conditions.

GENERAL FILTER CO.
AMES, IOWA

AERATORS • CHEMICAL FEEDERS • CHEMICAL MIXING EQUIPMENT • CHLORINATORS
COAGULATORS AND MIXERS • FILLERS • TASTE AND ODOR REMOVAL • IRON RUST
REMOVAL • WATER SOFTENERS • ZEOLITES • SLUDGE CLARIFIERS
PROPORTIONATING PUMPS • CHEMICAL FEEDERS • DEGASIFIERS • AERATORS

More EQUIPMENT NEWS

Begins on page 170

takes 7-, 3-, 1½-, or 2/3 sec, with a wide variety of ranges. Controlling models with all types of air and electric control action are available. Bulletin P1245.
The Bristol Co, Waterbury 20, Conn.

For more data on these items, use post cards, p179. Identify request with P and number.

AIR BLASTER

P925 • Heavy duty, high velocity air blaster for industrial use in foundries, kilns, pipe bending operations, etc, is portable—can be moved by hand or crane. Totally enclosed ball bearing motor drives directly a cast aluminum, non-overloading airfoil propeller, protected by heavy mesh wire guards at both ends. Type PLDUP is made in sizes 18 to 42 in., 6600 to 34,000 cfm. Bulletin 406-A.
Chelsea Fan & Blower Co, Inc, 639 South Ave, Plainfield, N.J.

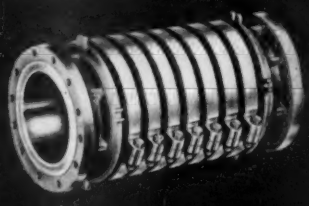
ELECTRICAL INSULATION

P963 • *Thermalastic* insulation is now being applied to waterwheel generators, synchronous condensers, and frequency changers. When first announced two years ago, it was applied to turbine generators rated 12,500 kva and larger. Since then, more than 4 million kw of turbine generators with *Thermalastic* insulation stator windings have been shipped.

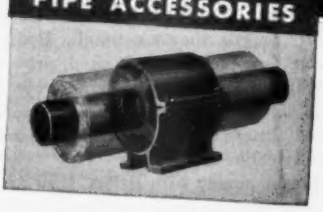
Although this insulation was readily applied to the half coils of turbine generators, a new winding technique had to be developed for the multi-turn full coils used on waterwheel generators, synchronous

ADSCO EXPANSION JOINTS

CORRUFLEX



PIPE ACCESSORIES

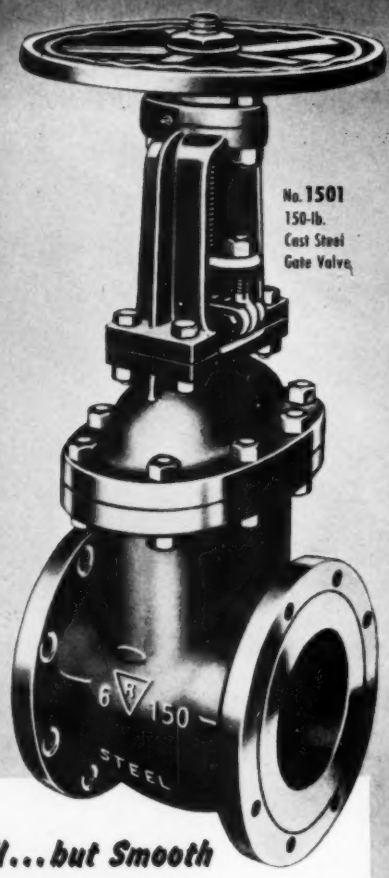


ADSCO'S piston-ring expansion joints can be serviced *and* packed under full-line pressure. That's why they're best. Simple and compact, they will absorb expansion caused by temperature differential in pipes carrying liquids, gases, or steam. The high-polish surfaces of these joints can never be scored, because the slips are in contact only with packing. Misalignment is prevented by both internal and external guiding. Write for Bulletin 35-15G. Remember, only ADSCO makes all types of expansion joints. We don't have to sell what you don't want to buy.

ADSCO
75 YEARS OF LEADERSHIP

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK

an ACCO product



TOUGH... but Smooth

• Electric furnace steel is used in the manufacture of R-P&C Cast Steel Valves. With all parts of equal strength, they are tough. Bodies resist distortion. One-piece yoke is rigid, provides permanent alignment. Gland packing stays tight at high pressures and temperatures. Requires little servicing. Internal design permits smooth flow and positive shut-off.

You'll save money with R-P&C Cast Steel Gate valves. See your R-P&C distributor or write the nearest R-P&C district office for information.

R-P&C valves

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

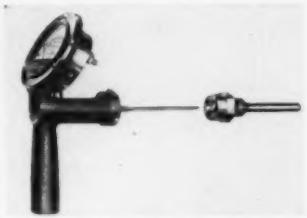
More EQUIPMENT NEWS

Begins on page 170

condensers, and frequency changers. This work has been completed, and such units rated 30,000 kva and above, employing 10 or more poles, can now be supplied for shipment in the last quarter of 1953 or later. If design allows, machines of smaller rating than mentioned may be available with this insulation.

Westinghouse Electric Corp, 306 Fourth Ave, Pittsburgh 30, Pa.

For more data on these items, use post cards, p179. Identify request with P and number.



PORTABLE DIESEL PYROMETER

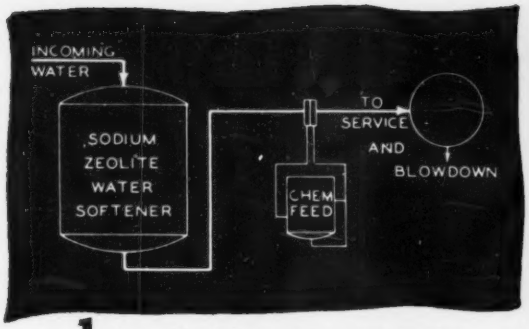
P919 • New portable diesel engine pyrometer is designed for test purposes and for installations where no permanently mounted pyrometer is available. The thermocouples can be installed in each cylinder and in the main exhaust line. Temperature can then be checked at any time by inserting pyrometer prongs into corresponding receptacles in terminal head of thermocouple. Model 4-321, Bulletin P1247.

The Bristol Co, Sales Promotion Dept, Waterbury 20, Conn.

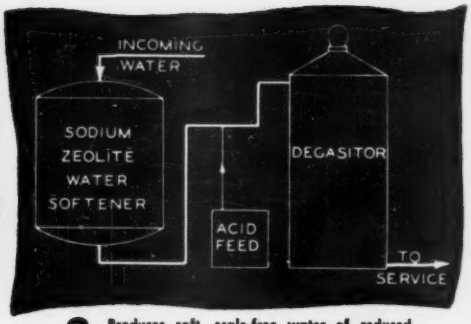
REFRACTORY ANCHORS

P918 • Newly developed refractory anchors give stronger, longer-lasting anchorages in both brick and monolithic construction. They are not cast but are made from high-alloy hot-rolled steel. Additional features are high tensile strength, 11,000 lb for ⅜-in. bolt; minimum scaling or oxidizing, uniform structure. They will expand or contract without affecting refractory wall, and are low in cost.

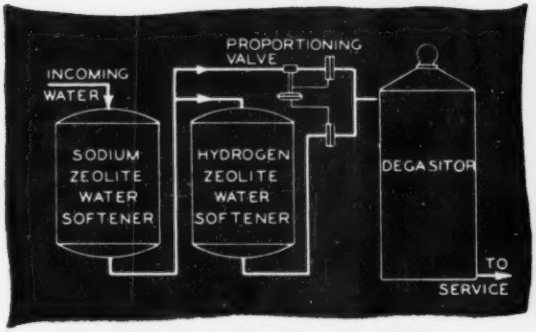
Super-Grip Anchor Bolt Co, Inc, 3333 N 22nd St, Philadelphia 40, Pa.



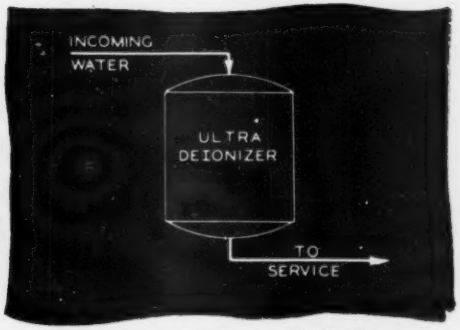
1 Gives soft, scale-free water — prevents corrosion.



2 Produces soft, scale-free water of reduced alkalinity.



3 Delivers soft, scale-free water. Reduces alkalinity to desired level and gives marked reduction in total dissolved solids.



4 Produces deionized water of highest known chemical purity. Removes CO_2, silica, and all ionizable solids.

Four ELGIN Ways . . .

to Control Dissolved Solids and Alkalinity of Boiler Feed and Process Water

With 43 years of experience in the design and manufacture of water conditioning equipment, Elgin is qualified to provide exactly the type of water conditioning system best suited to your specific needs.

This is well illustrated by the four typical ion exchange systems diagramed above which deliver water "tailored" to the specific requirements of any boiler plant or processing operation. It will pay you to study these diagrams one by one.

In many cases a zeolite water softener supplemented by chemical treatment (diagram 1) will deliver water of suitable quality for the purpose at low cost.

Where soft, scale-free water of reduced alkalinity is required, zeolite softening plus acid feed and degasification (diagram 2) is the economical answer for many water supplies.

Should a marked reduction in total dissolved solids also be desired, blended sodium and hydrogen zeolite softened water plus degasification (diagram 3) will best do the job.

For the highest quality water known today, the Ultra-Deionizer (diagram 4) is the ultimate in water conditioning. This remarkable single-tank unit which contains mixed anion and cation exchange resins, delivers chemically pure water, free of silica and CO_2 at an amazingly low cost.

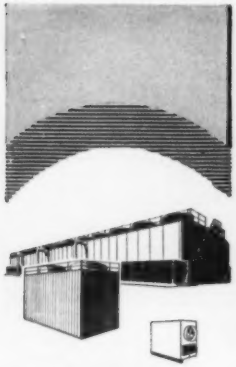
Yes, these are typical examples of the broad scope of Elgin water conditioning. One of our engineers will be glad to study your conditions and lay out a "tailored" system which will best fit your need and budget — permanently solve your water problem. Write us today.

ELGIN
Economical
WATER CONDITIONING
FOR EVERY NEED
SINCE 1908

ELGIN SOFTENER CORPORATION

130 N. Grove Ave., Elgin, Ill.

Representatives in Principal Cities



COOLING TOWERS

"That Pritchard Tower Is Sure Doin' A Job For Us"— Says Refinery Superintendent.

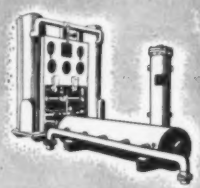
We got a tough assignment back in '49. Our customer needed a tower which would cool more than 4,000 gallons of recirculating water per minute from 105° down to 85° F., only 5° above the ambient wet bulb temperature. His entire process depended completely on 85° water —there could be *no* excuses! Could we do it?

We could, and we did. A few months later the Pritchard series "J" Induced Draft Cooling Tower with separate coil shed pictured above was put into operation.

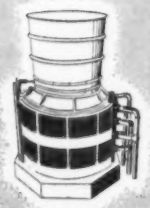
Today, according to the plant superintendent, this tower is consistently equalling or exceeding the design performance in accordance with the test procedures outlined by the ASME, with the operating crew taking their own test readings.

Naturally, when additional water cooling capacity was needed by this customer recently to take care of further plant expansion, another Pritchard Cooling Tower was *specified* for the job.

Why don't you, too, find out about the advantages of using Pritchard Cooling Towers in your plant? Consult your nearby Pritchard representative for full information.



GAS EQUIPMENT



AIR COOLED HEAT EXCHANGERS

Write for Bulletins

Producers of QUALITY Specialized Process EQUIPMENT

EQUIPMENT DIVISION
J.F. Pritchard & Co.
Dept. No. 113 908 Grand Ave., Kansas City 6, Mo.

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CHICAGO • HOUSTON • NEW YORK • PITTSBURGH • TULSA • ST. LOUIS
Representatives in Principal Cities from Coast to Coast

MARMADUKE

Continued from page 158

the bottle disappear into the fresh coal.

Finally the Chief gave up and left. But he hadn't been gone ten minutes when there came a crackling explosion from the furnace. Marmy's gin, at least the alcoholic content, had joined in the process of combustion, a little violently, in fact. I visualized pieces of the bottle flying all over the fuel bed, with glass in the hot ashes. And in my mind's eye I could see molten glass running down through the grate links.

Then F-L-A-S-H! By some strange quirk of my mind, I saw molten glass melting out the bottom of a babbitt ladle many years before.

I went down the ladder and crawled into No. 3's furnace, where Marmaduke was building a brick wall. "Do you make a habit of throwing your dead soldiers into the stoker hoppers?" I asked.

"BILGEWATER ON DEAD SOLDIERS," roared Marmaduke, wiping a blob of fire clay off his gray bowler. "That soldier wasn't dead, mate—not by a long shot."

I told him of my experience with the molten glass years before.

"And now it registers," I said. "It's been your Sandpaper Gin bottles that've been burning out those stoker links right along." Marmy's eyes popped. Then he threw down a firebrick he held in his hand.

"You hit it right on the head," he bellowed, slapping me on the back. "Funny I didn't dope that out myself." Then he added thoughtfully, "That just goes to prove it pays to bend the elbow. How else would I have learned about this highly scientific fact?"

I never told on Marmy, and to this day the management has been trying to solve another riddle. That is why they have so many unused stoker links rusting and gathering dust in their spare parts room.

OLIN LEE BRAGE
Cowiche, Washington

EDITOR'S NOTE: *Just wait until Marmaduke reads this. He'll blow a gasket or two—for sure.*

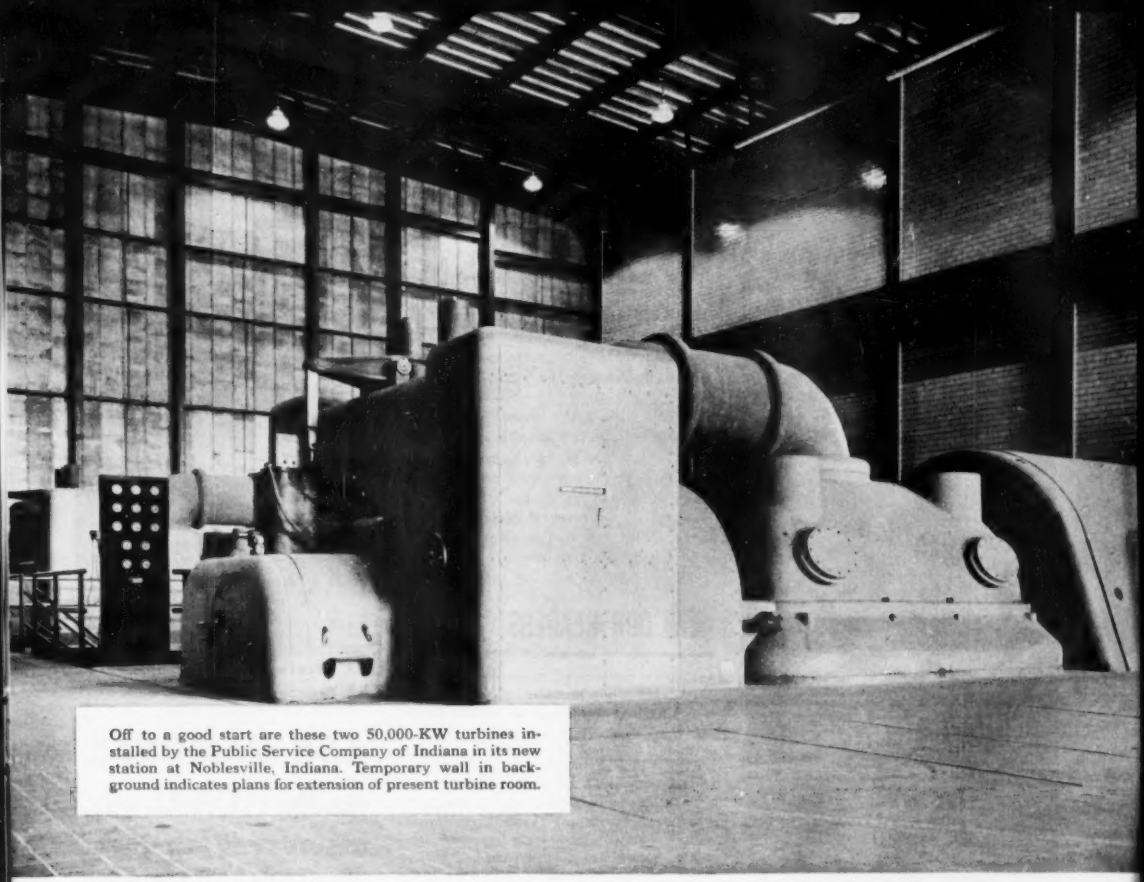
More PLANT PROBLEMS

Begins on page 148

induced-draft fan at higher temperature. Fan capacity decreases because high-temperature gas isn't as dense.

2. Draft loss goes up when gas passages become choked. Gas must move at a higher velocity through smaller-diameter tubes or narrower passages.

3. Ash build up on cold end of heater keeps metal temperature below that of



Off to a good start are these two 50,000-KW turbines installed by the Public Service Company of Indiana in its new station at Noblesville, Indiana. Temporary wall in background indicates plans for extension of present turbine room.

New turbines with the future guaranteed

● When these two 50,000-KW turbines were placed in service recently for the new Public Service Company of Indiana generating station at Noblesville, Indiana, NONPAREIL Turbine Oil was used for the initial fill . . . assuring trouble-free lubrication for the life of the turbines themselves.

With this installation, as with every installation of NONPAREIL Turbine Oil, plant operators received a written guarantee that the oil will last as long as the turbines and will never exceed a neutralization number of 0.15 mg. KOH/gm. Lasting, low-acidity assures that NONPAREIL will not have to be removed for treatment or for cleaning the lubrication system.

For guaranteed lubrication in your own turbines . . . new or old . . . fill with NONPAREIL. A Standard Oil lubrication specialist can show you the facts, including service records covering up to twenty-three years continuous operation of NONPAREIL Turbine Oil. Contact your local Standard Oil Company office. Or write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
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Turbine Oil

STANDARD OIL COMPANY

STANDARD *(Indiana)*

avoid costly field corrections when installing...

floor gratings

with Bordens free planning and checking service

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BORDEN

BORDEN METAL PRODUCTS CO.

Green Lane, Elizabeth, N. J. P-9

Gentlemen:

Please send me Borden Catalog No. AT-253.

name.....

co. name.....

st. and no.....

city, state.....

See our Catalog in Sweets

gas. Deposits are porous. The flue gas passes into pores and contacts metal. With metal temperature below dewpoint, there may be rapid corrosion under the deposit even though gas temperature is higher. So play safe and clean entire heater before raising exit-gas temperature.

S M Topp *New York, N. Y.*

REGULATE LOAD so flue-gas temperature doesn't drop too low. Flyash and soot adhere to tube surface and form a hard scale when gas temperature is low.

Check with boiler manufacturer on lowest temperature allowable in air heaters. Then, since *JL* has several boilers, he can take one or more off the line when load is so low he can't hold right flue-gas temperature. If boiler can't be taken off line, air recirculating dampers may do the trick.

Jerry Trncak *E. Alton, Ill.*

WITH OUR READERS

Continued from page 5

has not yet commenced. There are numerous advantages in applying these cooling towers, which were not mentioned in Mr Farmer's article. (Space limitations made it necessary to condense Mr Farmer's article heavily.—Ed.) *It might be interesting to mention a few of these advantages:*

Properly built reinforced-concrete-shell structures require practically no maintenance. The elimination of large-capacity fans relinquishes considerable electric power which can thus be used for productive purposes. Due to their immense moment of inertia, such towers offer complete safety against high winds, tornadoes and earthquakes. Rotational shell structures are stable, efficient and economical.

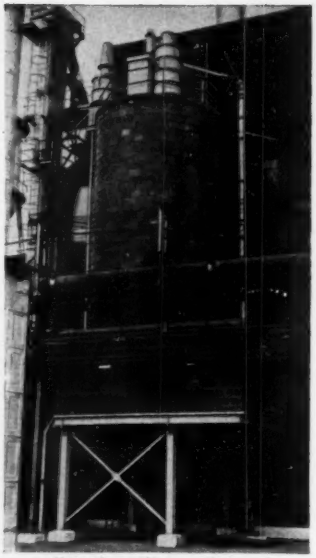
The installation of such towers permits the relocation of power stations to the proximity of industries, thus minimizing need for transmission lines. The stations can also be located nearer available fuel supply.

By removing power stations from the river banks, which usually have rather poor soil-bearing capacity, large savings can be attained in the design and construction of the foundations. Expensive cofferdams, caissons, thick slabs which counteract buoyancy, etc, can all be eliminated, together with the crib-houses, circulating-water tunnels and related structures. Small makeup (1%) means a small water supply.

The writer is a director of a newly formed organization, Intercontinental Technical Enterprises, Inc, 677 North Michigan Ave, Chicago 11. *One of the purposes of this organization is the promotion in this country of the L G Mouchel & Partners hyperbolic reinforced-concrete cooling towers.*

Chicago, Illinois Paul Rogers

Reader Rogers puts forward some interesting points—what do the tower designers have to say about the construction angles, and what do power-plant designers think about the general design considerations? We'll be glad to hear from you and to make room for your comments.—Ed.



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ASH REMOVAL the NATIONAL way assures you low-cost, dependable service

Are ash removal costs a factor in cutting your profits? We suggest a survey by a National engineer. It will cost you nothing. It may avoid wasted dollars.

NATIONAL PNEUMATIC STEAM ASH REMOVAL SYSTEMS

save money in two ways—

1. Exceptionally easy one-man operation cuts labor cost to the bone.
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A complete and effective service policy and a reputation for delivering satisfaction are extras that go with NATIONAL installations.

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Four ways to measure REAL PUMPING ECONOMY

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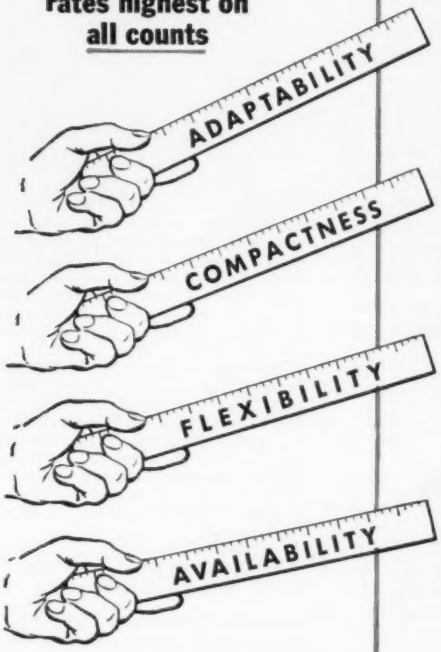

The Motorpump line is so complete that you can get a pump that's designed to handle your particular capacity and head requirements at *maximum efficiency*. Sizes range from ¼ to 50 hp, for capacities from 5 to 1800 gpm and heads to 650 ft.

The space-saving design and light weight of the unit-type Motorpump cut installation costs. Motorpumps can be mounted in "close quarters" where no other type of pump would fit. No special foundations are required.

Motorpumps operate equally well in *any position*—can be mounted horizontally, vertically, or any angle; on floor, wall, columns or ceiling. This flexibility of mounting often permits simpler and more economical piping arrangements.

Despite current shortages of many industrial products, you can still get prompt delivery on Ingersoll-Rand Motorpumps. Most of the popular sizes are carried in stock and can be delivered immediately from branch or factory. This avoids costly delays—both in pump replacement and new installations.

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Wallace & Tiernan equipment because it is versatile, sturdy and dependable — proven by thousands of successful installations, vouched for by satisfied users everywhere-and because there's a Wallace & Tiernan chlorinator for every job. Write today for information on how Wallace & Tiernan chlorination may help you solve *your* slime problem.

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BOOKSHELF

Electrical Engineering: Theory and Practice. *by W H Erickson and N H Bryant, electrical engineering dept, Cornell University. 6¼ x 9¼, 523 pp, $6. John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, N. Y.*

Stressing analysis and study rather than straight formula-substitution, this book gives a clear understanding of basic theory of circuits, machines and electronics. It is especially suited to the needs of non-electrical engineering students.

In presenting theory the authors emphasize factors that influence intelligent application or selection of equipment. Little stress is placed on design details. Although mathematical analysis of the operation of circuits and machines is not avoided, physical analysis is stressed. For that reason certain methods of treatment, like the equivalent-circuit concept for ac machines, have been omitted. Similarly, ac theory is presented without complex notation.

Electrical Reference. *2nd Edition. By E S Lincoln, Electrical Modernization Bureau, Inc. 8¼ x 11, 1744 pp, 1976 illust, 600 tables. $25. Electrical Modernizaiton Bureau, Inc, 110 Mamaroneck Ave, White Plains, N. Y.*

First edition of the *Reference Book* proved of practical value to plant electrical engineers, maintenance men, electrical contractors, design engineers, and others interested in industrial and commercial applications of electric power. Book covers the practical aspects—description, ratings, operating principles, functions of electrical equipment, plus methods used in industry.

New edition has been revised and expanded to include the latest information on equipment and its uses. This information is simply presented by means of text, diagrams, charts and tables. Volume should be helpful since it shows how electrical equipment works, plus how to operate, maintain and where to buy it.

Text is divided into 26 sections. Partial listing includes Electrified Industry, Electrical Fundamentals, Industrial Wiring Systems, Electrical Control, Electrical Protective Equipment, Motors and Generators, Signal and Communication Systems, Transformers, Batteries, Industrial Electronic Equipment, Electrical Measurements, Maintenance of Electrical Equipment, Mechanical Drives, etc.

Entire 1951 *National Electrical Code* is included. However the various articles in the Code form part of each section.

Direct-Current Machinery. *By C S Siskind, assistant professor of electrical engineering, Purdue University. 319 pp, 6¼ x 9¼, $6. McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, N. Y.*

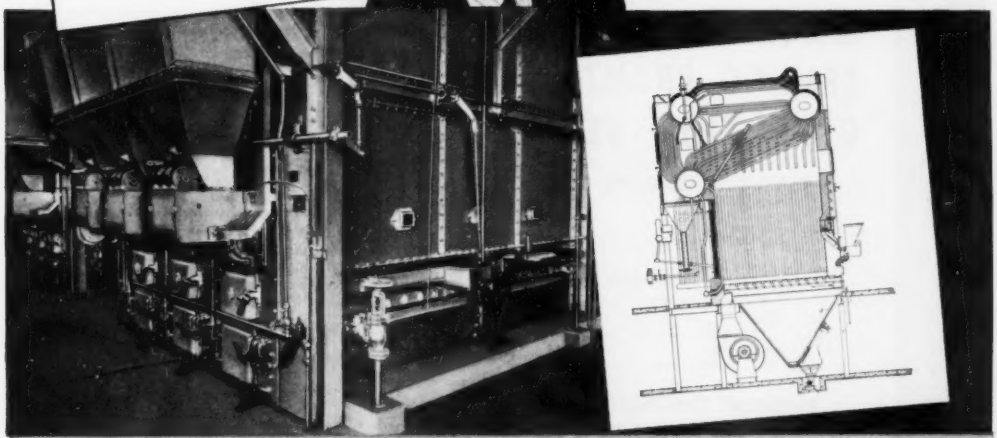
This book was written to present fundamental up-to-date material in a one-semester, dc machinery course. Assuming a background of elementary principles in electric and magnetic circuits, the author moves through the fundamental theories of generators and motors, operation, control equip-

"WE SAVE OVER $68,000 A YEAR— BY BURNING COAL THE MODERN WAY!"

"New coal installation cuts fuel consumption 32%... labor costs 22%!"

says Mr. H. A. Sherer, Chief Engineer, Reeves Steel & Manufacturing Co., Dover, Ohio.

"We installed two new boilers and stokers and a modern coal- and ash-handling system. Here are our yearly savings: $38,576 saved on fuel, $9,353 on labor, $20,739 on repairs and maintenance. That's a total of $68,668—saved by burning *bituminous* coal the modern way!"



A view of the plant's firing aisle and a diagrammatic drawing of one of the boilers. It now costs 18.8¢ less to generate every thousand lbs. of steam. This is a saving large enough to amortize the entire installation in 3 years-3 months. And that includes all the cost incurred in tearing out old equipment and constructing a new plant floor!

● Today, *bituminous* coal's inherent economy has been greatly increased. Modern combustion installations give you more steam for every dollar . . . automatic coal- and ash-handling systems cut labor costs to a minimum.

A consulting engineer can show you how coal can do a better job—*and save you real money*—in a plant designed to meet your *specific* needs.

In addition, with coal you get the basic advantages of price stability, and dependable supply. These advantages are assured by America's virtually inexhaustible coal reserves and the high productivity of America's coal industry.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

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COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

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A Department of National Coal Association, Washington, D. C.

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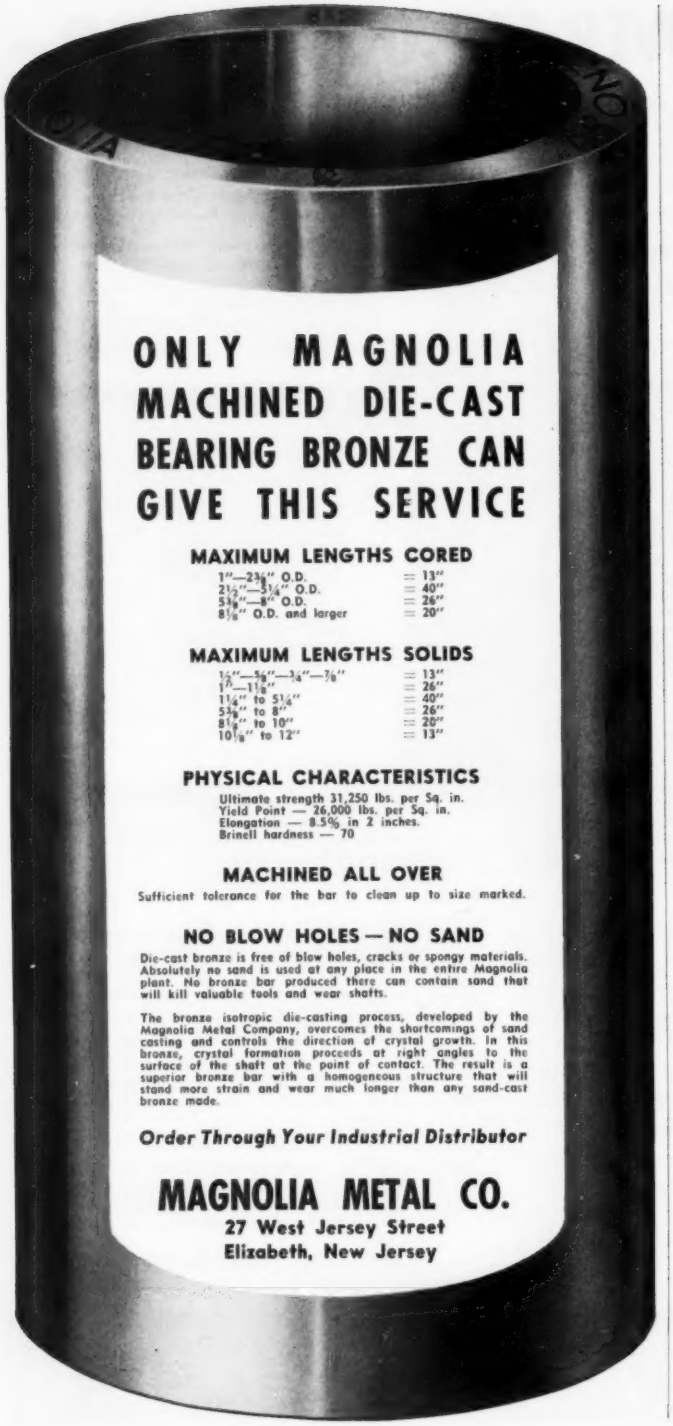
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More BOOKSHELF

Begins on page 210

ment, construction and application.

Mathematical derivations are rigid and complete. Derived equations are used throughout the text. Graphical methods of illustrating are used wherever feasible. Every topic is discussed in terms of fundamental principles and their application to present-day practice.

Electric Circuits and Machines. *(1952—2nd Edition). By Eugene C Lister, Stanley Engineering Co. 427 pp, 6¼ x 9¼, $5.50. McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, N. Y.*

A text designed for a fundamental course. Mathematics has been limited generally to simple algebra. Emphasis is placed on principles and on physical action, rather than on a detailed analysis of theory. Many examples are worked out in detail.

This new edition gives the reader a concise over-all picture of the electrical field covering both dc and ac machines. Among the subjects included are circuits, batteries, magnetism, induction, dc and ac generators, various motors and controls, transformers, instrumentation and electronic tubes.

Nomography and Empirical Equations. *By Lee H Johnson, Dean, College of Engineering, Tulane University. 150 pp, 92 fig., charts, $3.75. John Wiley & Sons, 440 Fourth Ave, New York 16, N. Y.*

The author develops the subject of nomograms from a knowledge of plane geometry and logarithms, avoiding the more advanced approach involving determinants. Empirical equations are treated on the basis of logarithms and analytical geometry. The chapter headings give a clue to subject coverage: parallel scale nomographs, Z-charts, parallel and perpendicular index lines, concurrent scales, recurrent variables, combined nomographs. The second part of the book covers empirical equations. The chapter headings are: methods of curve fitting, curves of two constants, curves of three constants, curves of four constants.

Two separate proportional charts are included for calibrating arithmetical, square-root, and logarithmic scales.

American Standard Square and Hexagon Bolts and Nuts *(ASA B18.2-1952.) Prepared by American Standards Association Sectional Committee B18. 36 pp, 8½x11 in., $2. American Society of Mechanical Engineers, 29 W 39th St, New York 18, N. Y.*

This new product standard contains complete dimensional specifications for bolts and nuts and recommendations on standard materials for these products. It eliminates needless variety by consolidating types of bolts and nuts that have similar proportions, characteristics and applications.

Further, it successfully concludes efforts of British, Canadian and American Standards Associations to unify their practices. This will permit standard designs of defense equipment and repair of battle damage or service using bolts and nuts that are standard in the three countries. In this edition, the "unified" dimensions are printed in bold face type.

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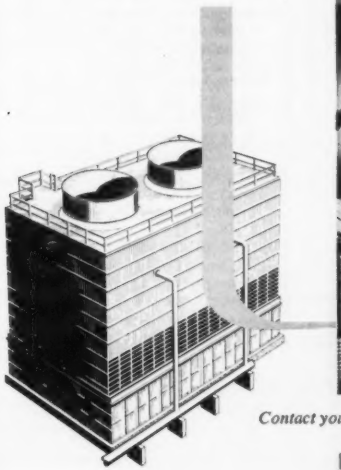
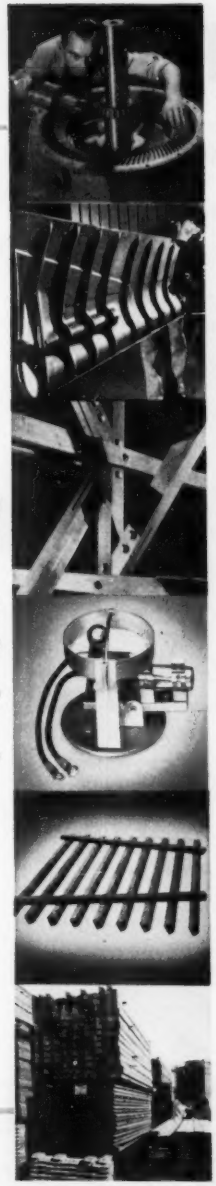
induced draft counterflo cooling towers provide these 6 exclusive features...





Spiral Bevel Gear Speed Reducers

Only Fluor-Western speed reducers incorporate curved tooth spiral bevel gears as standard design. This proven principle provides quieter, smoother, more efficient operation under the rugged conditions of cooling tower service. Other special design features include: oil-bath lubrication; dry air breather; chrome-plated shaft at oil seals; and, low-speed fan shaft mounted on special steep angle thrust and radial bearings to take combined gear thrust, fan thrust, and weight of fan assembly.

Unique Fan Blade Design

The Fluor Type HC Stainless Steel Fan blades, furnished as standard on every Fluor Counterflo Cooling Tower, are a joint development of The Fluor Corporation and Solar Aircraft Company. Designed specifically for induced draft cooling tower service, their unique air foil handles maximum air volumes at minimum tip speeds and horsepower requirements. Design *plus* mechanical arrangement eliminates recirculation of air and resulting power-consuming turbulence.

Internal Gusset Plate Construction

Fluor Counterflo Cooling Towers alone make full use of tensile as well as compressive strength of structural members! Their internal gusset plate design duplicates that used in wooden bridge construction. These simple, yet extremely strong joint connectors mean longer tower life, lower total tower weight, fewer and simpler castings, greater ease of erection, and minimum spoilage should the structure be dismantled, moved and re-erected.

Patented Vibration Cut-Out Switch

The Vibration Cut-Out Switch developed and patented by Fluor in 1944 protects tower structure and mechanical equipment by stopping the motor should excessive vibration suddenly occur. In addition to its value as an emergency safety device, the switch can be utilized by the operator as a positive "on-off" switch during routine inspection of tower structure and mechanical equipment. The motor cannot be started accidentally once the switch is placed in the "off" position.

Sloping-Bar Grid Decking

Exclusive Fluor-designed sloping-bar grid decks are of rough-finished 1" select redwood machine-nailed to 1" x 2" cleats—strong enough for use as scaffolding during erection, rugged enough to withstand the erosion of falling water. This means low maintenance and replacement cost. The sloping-bar design and arrangement of each deck cross member combines the advantages of maximum deck surface with minimum air pressure drop through tower.

Complete Prefabrication of Structure

Only Fluor Counterflo Cooling Towers are completely prefabricated. This offers many advantages to the operator. Tower parts are "packaged" for rapid delivery, marked for orderly erection. Erection is faster, easier, at lower cost. All cutting, drilling and nailing is completed at the factory. Prefabrication means standardization—low-cost replacement of standard parts that may become damaged over the years. It means uniformity in both performance and appearance.

Contact your nearest Fluor representative for detailed information. You Can Be Sure With Fluor

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National Exposition of
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GRAND CENTRAL PALACE, New York

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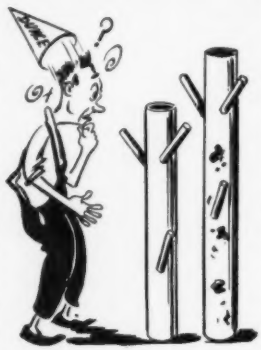
ASME Auspices in conjunction with Annual Meeting

MANAGEMENT INTERNATIONAL EXPOSITION CO.



My Biggest Boner

► IN ONE DEPARTMENT of our industrial plant we patched up a copper kettle several times to keep it on the line. It hobbled along quite awhile before it finally sprang a leak serious enough to make us shut down.

Leak was in a heating coil made of 12-in. dia steel pipe having several smaller branches along its length. I got a sketch of the coil from the engineering office, rounded up some pipe and borrowed a 25-ft measuring tape. I gave these to our welding crew, telling them to hop to and finish the coil in a hurry.

They did but when we put the new coil into the kettle we all groaned. It was about a foot too short and the branches didn't line up with kettle connections. I blamed the sketch but when we checked it against the old coil we found all sketch dimensions were right.

I fumbled around trying to figure where we had lost that foot of length. Then an idea flashed through my mind. I got the measuring tape out and looked it over carefully. Between the tenth- and eleventh-foot marks 11 in. of tape was missing. Someone had neatly stitched the ends together.

So take my advice. Check your instruments thoroughly before use. Or else you may end up in a mess like I did.

N S THYAGARAJAN
Alwaye, India

● What is your "biggest boner"? We'll pay ten dollars for each one we publish.

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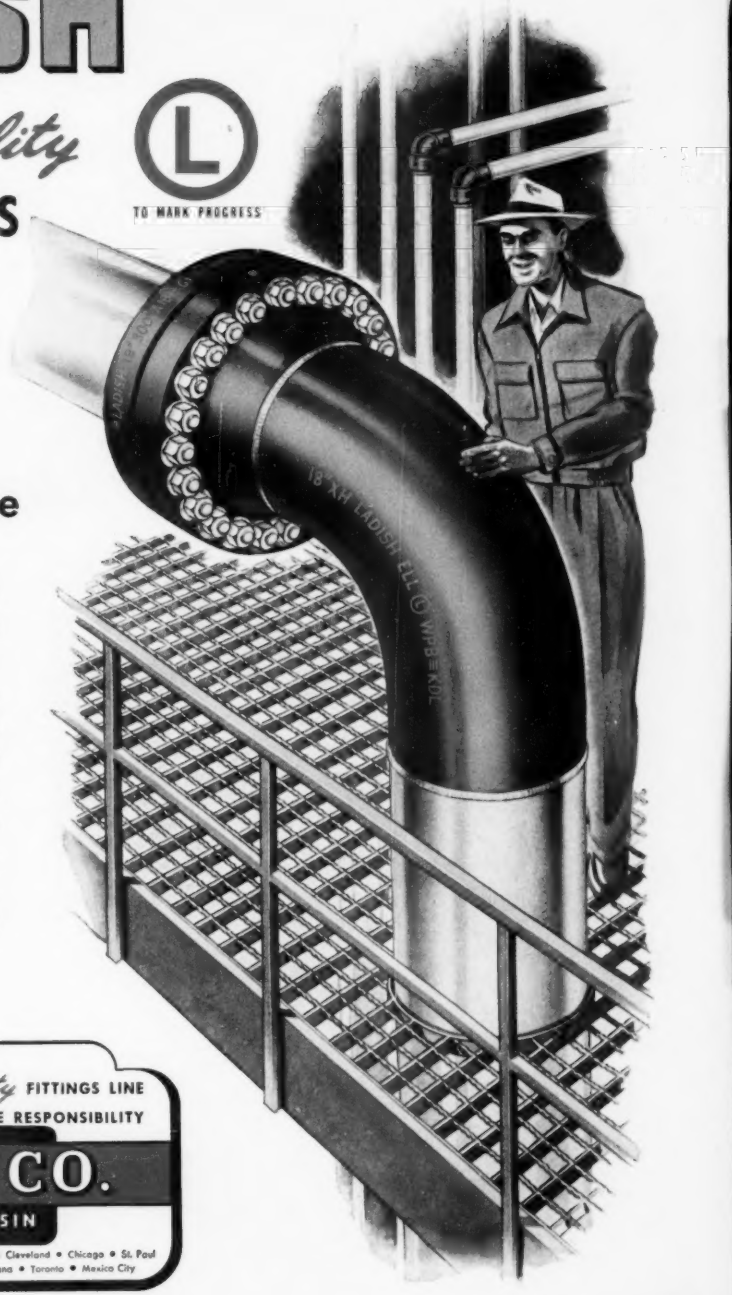

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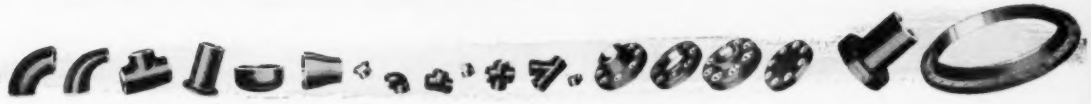

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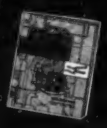
Bulletin 5000 describing Dearborn's Industrial Water Treatment and Engineering Service will be sent on request.



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Over the past 23 years, thousands of industrial organizations have expressed their confidence in our products by reordering not once, *but time and time again!*

Here's a sample of the record:

Company	Number of Orders Placed*	Since
American Viscose Corp.	79	1940
Bethlehem Steel Corp.	51	1935
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Consolidated Edison Co.	115	1933
Dravo Corporation	53	1939
E. I. du Pont de Nemours & Co., (Inc.)	308	1934
Ebasco Services	46	1934
Hercules Powder Co.	133	1937
Koppers Co., Inc.	165	1942
Nordberg Mfg. Co.	174	1942
Sun Oil Co.	60	1935
Texas Co.	261	1938

**Including as many as 485 expansion joints in a single order!*

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Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for copies today.

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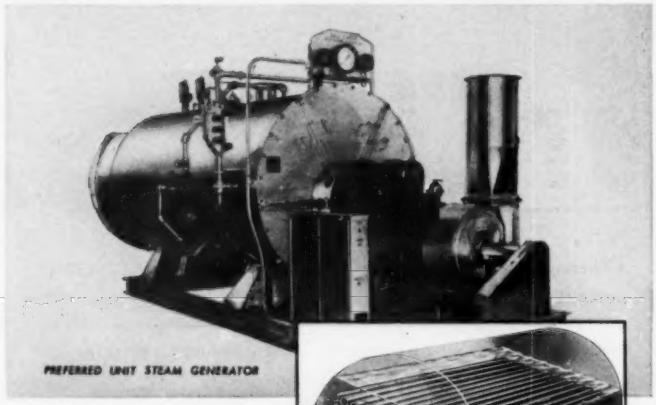

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*One of the many Preferred's 25-year features that insures dependable performance. Five square feet of heating surface per boiler horsepower.

PREFERRED *never compromises* QUALITY!

Another one of the many outstanding "quality features" of the Preferred Unit Steam Generator is the basic design of five square feet of heating surface per boiler horsepower.

Hundreds of installations, backed by many years of experience and records, have consistently proved — many times over — that this ratio affords maximum practical thermal efficiency and maximum life expectancy . . . *25 years of dependable, low maintenance-free service at a minimum efficiency of 80%.*

With Preferred Unit Steam Generators, five square feet per boiler horsepower and lower BTU heat release offer, in turn, a lower temperature gradient preventing steam blanketing of wet surfaces, a cause of pressure vessel loss. An increase in temperature gradient through insufficient surface, higher BTU heat releases and consequent steam blanketing rapidly increases the rate of precipitation, vitally affecting life expectancy, maintenance and operating costs.

— This feature . . . and many other "quality features" are described in detail in Bulletin 2000.

PREFERRED UTILITIES MFG. CORP.

1860 BROADWAY • NEW YORK 23, N. Y. 010

More TECHNICAL BRIEFS

Begins on page 166

gines, with due regard for the effects of differences in size, speed, and operating conditions. *ASME paper. No number.*

Lubrication

Lubrication Problems in Design of Heavy Duty Engines. *By W J Blessing, Worthington Corp.*

The manufacturer has no control of proper maintenance, once the engine has been delivered. His responsibility therefore, lies in providing a design that can operate efficiently within an oil "specification" range determined by him. Increases in ratings and speeds of commercial engines require changes in lubricating oil recommendations. More emphasis is now given to viscosity, resistance to heat, low carbon formation, and non-sludging characteristics.

Briefly these four properties determine the ability of an oil to distribute itself throughout the engine, its resistance to oxidation, its behavior in the upper compression ring zone toward preventing solid carbon, and lastly its characteristic of keeping the engine clean by keeping the contamination in suspension. The trend toward additive type oils with these characteristics is unmistakable. New methods of evaluating oil changes by frequent chemical analysis becomes important. More recently the use of inferior fuels has demonstrated the superiority of low additive lubricants. For the average medium-speed, conservatively rated engine where a good grade of fuel is used, a straight mineral oil has been found satisfactory.

For lubricating oil to perform satisfactorily, it must be of good quality and proper viscosity. We believe that most of the acceptable oils today contain some type of oxidation inhibitor and perhaps other additives. Whether detergents are necessary is left to the discretion of the oil vendor, unless the engine builder's experience shows that detergents are required.

Lubricating oil for turbochargers may need anti-foaming properties or an anti-foaming agent. Since the turbocharger oil system is usually independent of the engine system, this can easily be taken care of.

An oil having a viscosity of 500 to 800 SSU at 100 F and 60 to 75 SSU at 210 F, with a flash point of 420-450 F should take care of practically all types of heavy duty diesel and gas engines. Where normal crankcase and jacket temperatures exist (not over 160 F) oils

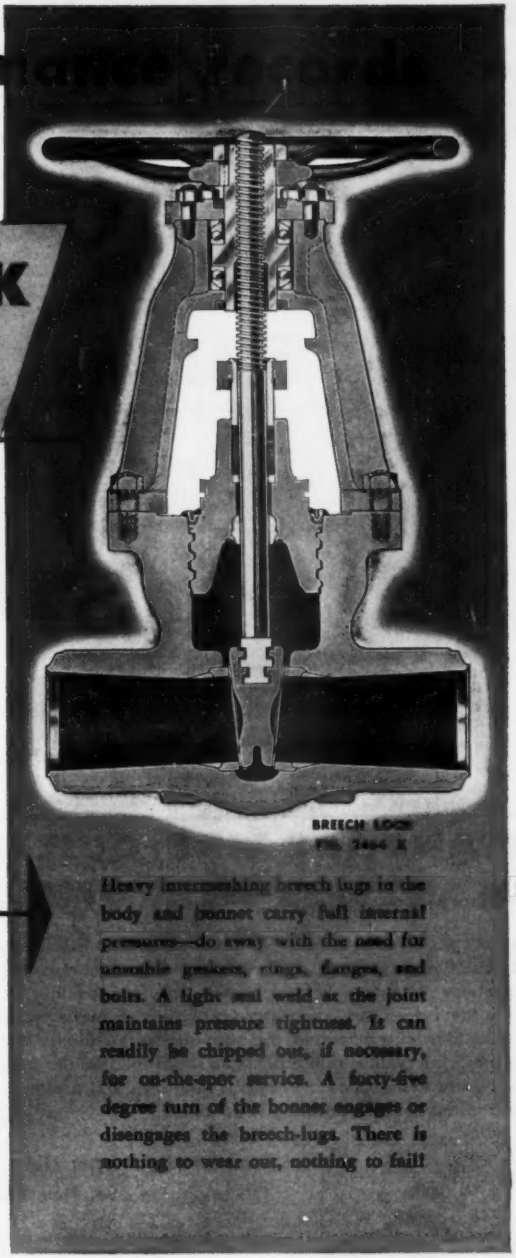
Directions for ordering papers on p 168

setting performance records for 15 years

BREECH LOCK VALVES

These exclusive Lunkenheimer Valves are the *only* high-pressure, seal-weld valves proven in the field for more than 15 years.

They have consistently cut maintenance costs and "downtime" in hundreds of leading power plants . . . set the standard by which other high-pressure valves are judged. Here's why:



BREECH LOCK
PAT. 2466 X

Heavy intermeshing breech lugs in the body and bonnet carry full internal pressures—do away with the need for unsuable gaskets, rings, flanges, and bolts. A light seal weld at the joint maintains pressure tightness. It can readily be chipped out, if necessary, for on-the-spot service. A forty-five degree turn of the bonnet engages or disengages the breech-lugs. There is nothing to wear out, nothing to fail!

WRITE FOR "Lunkenheimer Cast Steels," an invaluable booklet describing WC4, the exceptional steel used for Breech Lock Valves. The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

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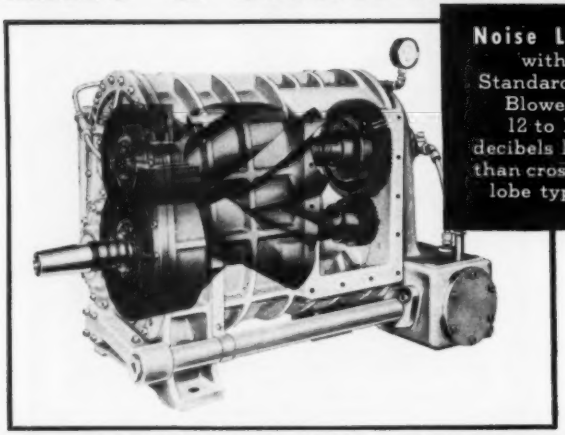
LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

MUST BLOWERS BE LOUD OR QUIET Like a STANDARDAIRE



Noise Level with Standardaire Blowers 12 to 18 decibels lower than crossflow lobe types.

STANDARDAIRE QUIETNESS MEANS LESS WEAR--MORE AIR

IMPARTIAL tests have proved conclusively that Standardaire Blowers with their smooth, gradual delivery action minimize shock and sound pulsations . . . a distinct contribution to quiet operation. Then too, the noise level does not noticeably increase with higher pressures. With the Standardaire principle you squeeze the air gently instead of slapping it . . . a feature that eliminates shock load on the internal parts of the blower. This, of course, means less wear and prolongs service life, even under severe operating conditions.

Write .....

Read Standard Corporation, Dept. F-15, 370 Lexington Ave., New York 17, N. Y.

AXIAL FLOW STANDARDAIRE BLOWER

BLOWER-STOKER DIVISION

READ STANDARD CORPORATION

NEW YORK • CHICAGO • ERIE • YORK • LOS ANGELES

More TECHNICAL BRIEFS

Begins on page 166

nearer the lower end of this viscosity range are satisfactory. For higher crankcase or jacket temperatures (around 180-200 F), oils nearer the upper limit are preferable. Where separate cylinder lubrication is provided, use a grade heavier oil for lubricating the power cylinders during the break-in period. For high atmospheric or jacket temperatures (above 200 F) it is desirable to use one grade heavier oil for power cylinder lubrication. *ASME paper. No. 52-OGP-1.*

Water Testing

Filming Amines Protect Heating Units and Condensate Lines. *By G A Mierendorf, A O Smith Corp.*

The same steam mains satisfy both heating and process needs in the author's plant, thus offering little opportunity to drain heating units and lines during the summer season. Conditions became critical for maintaining heat in buildings with an unusual amount of heater failures and piping replacements. With one billion pounds of steam generated annually, and 50% condensate recovered, treating cost could easily get out of range. So they selected filming amines as their treatment.

After using filming amines for a short while an unanticipated operating problem developed. The filming amine did coat the internal surfaces of the piping with a monomolecular film, but it also loosened scale particles, packing waste, oil and whatever deposit was present. Steam traps failed and strainers clogged. After one heating season the trap and strainer trouble receded to spotty failures that could be considered normal to heating operations.

To avoid a failure of traps to the extent mentioned it may be advisable to feed the filming amine at a lower rate than recommended for the first few months and gradually increase the rate to achieve the desired protection. In this manner the system will discharge foreign matter at a rate that can proceed without fouling traps and strainers. In this case they were interested in correcting and relieving the corrosion difficulty as quickly as possible. *APC paper. No number.*

Continuous Measurement of Dissolved Gases in Water. *By J K Rummel, S T Powell Engrs, Baltimore, Md.*

Measuring dissolved gases in water is a most interesting and important part of the analytical procedures for condi-

Directions for ordering papers on p 168

SORENSEN *electronically*

REGULATES AND CONTROLS

FREQUENCY

AC LINE

HIGH VOLTAGE DC LOW CURRENT

LOW VOLTAGE DC HIGH CURRENT

Model 2000S

SORENSEN ISOTRONIC AC LINE REGULATORS ARE YOUR BEST CHOICE FOR PERFORMANCE PLUS ECONOMY

The man who uses instruments likes Sorensen AC Line Regulators because of regulation accuracy, clean waveform, insensitivity to frequency fluctuation, load range.

The man who maintains instruments likes Sorensen AC Line Regulators because of circuit simplicity, conservatively rated tubes (only 3 in all), built-in ability to deliver trouble-free performance for months on end.

The man who pays for instruments likes Sorensen AC Line Regulators because of reasonable price and the fact that there are no extras for installation and special wiring.

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OTHER SORENSEN ISOTRONIC PRODUCTS INCLUDE:

NOBATRONS
(low-voltage, high-current DC Supplies)

B-NOBATRONS
(high-voltage, low-current DC Supplies)

NOBATRON-RANGERS
(full-range-variable DC Supplies)

FREQUENCY CHANGERS

SATURABLE CORE REACTORS

VARIABLE AUTO-TRANSFORMERS

ELECTRICAL SPECIFICATIONS

Models available (numbers indicate VA capacities)		
	Input	95-130 VAC, 1φ, 50-60~; 190-260 VAC in "-2S" models
	Output	115 VAC ±5%; 230 VAC in "-2S" models
150S 250S	Regulation accuracy	±0.1% against line or load
500S (-2S also) 1000S (-2S also)	Distortion	2% - 3% maximum
2000S 3000S (-2S also)	P. F. range	Down to 0.7
5000S (-2S also) 10000S (-2S also)	Load range	0 to full load
15000-2S	Miscellaneous	Models 150S, 250S, 500S, 1000S, 5000S, 10000S, and 15000-2S are self-contained. Cabinets available for others.
1001	Regulation accuracy 0.01%, load range 0 - 1000 VA, output 115 VAC ±5%, other characteristics similar to those given above.	

* ISOTRONIC=Regulation and control of voltage, current, power, and frequency by electronic means.

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For Complete Information Write

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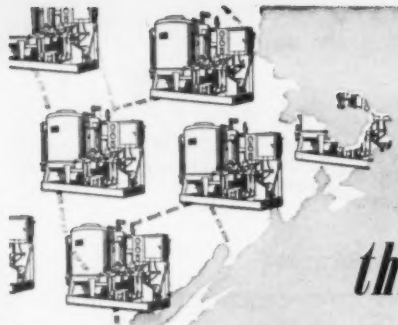
375 Fairfield Avenue Stamford, Conn.



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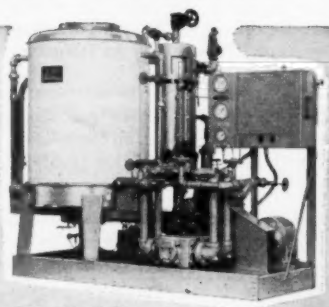
THERE ARE MORE *Clayton* FORCED RECIRCULATION STEAM GENERATORS IN USE THAN *ALL OTHER PACKAGE TYPE BOILERS COMBINED

*Self contained steam generators of from 15 to 100 horsepower



for the reason and proof of this statement mail the coupon

THIS COUPON BRINGS **PROOF** TO YOUR DESK

An animated, colored flow chart shows you how and why the Clayton Forced Recirculation principle can cut your steam costs.

P-9

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Send name of nearest distributor and arrange desk demonstration of Clayton Forced Recirculation principle. Send catalog.

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MANUFACTURING COMPANY
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More TECHNICAL BRIEFS

Begins on page 166

tioning or purifying industrial water. Knowledge of the dissolved gas content has many and varied applications, like controlling or measuring corrosion, controlling degasifiers, regulating gas concentrations for specific purposes, disposing of waste waters, and other treatment controls.

Frequently, intermittent measurements are sufficient for general information. But where close control of dissolved gases is necessary, measurements should be continuous.

To select a preferred method for continuous measurement, you must study the conditions, the basic analytical methods and the equipment that can be made available or developed. Primary considerations in selecting the methods are: (1) application of results, (2) degree of accuracy required, (3) range of concentration of the dissolved gas, (4) interfering materials in the water, (5) availability and cost of equipment, (6) maintenance and operating difficulties. *ASTM paper. No number.*

Measurement of Color, Turbidity, Hardness, and Silica in Industrial Waters. *By F C Staats, Hercules Powder Co.*

The importance of the quality of water used for drinking purposes and in power generation has been recognized for many years. Only recently, however, has attention been sharply focused on close control of water quality in processing chemical products.

In chemical processes, water may be used as a reagent entering directly into a reaction, as a solvent or carrier for a reaction, or as an extractant or scrubber of products.

Regardless of the nature of a plant water supply, some treatment and control is usually required. After the process water becomes waste water, further treatment and control are usually necessary to meet antipollution requirements or to avoid loss of recoverable products.

The problem of measuring water treatment effectiveness quickly, accurately, and as cheaply as possible is common to most chemical companies—in fact, to all industrial and municipal water plants. At a glance, continuous analysis appears to be the "open sesame." But its adoption at present requires extensive individual development, even though a few commercially developed units are available.

The author reviews accepted laboratory methods for measuring color, turbidity, hardness, and silica in industrial

Directions for ordering papers on p 168

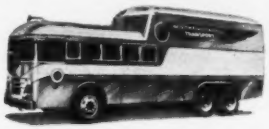
IN ALL INDUSTRIES

LUBRIPLATE LUBRICANTS

EXCEL IN REDUCING FRICTION, WEAR, UPKEEP-COSTS AND POWER-CONSUMPTION...WITH BETTER MACHINE PERFORMANCE

"THIS LUBRICANT CUT OUR PARTS REPLACEMENT 50%"

– says NORTHERN PACIFIC TRANSPORTATION COMPANY



"LUBRIPLATE proved so satisfactory during tests that we installed it in all our worm-gear, hypoid, and two speed axles. This enabled us to change our oil-change period from 15,000 miles to 40,000 and on some applications, depending on speeds and temperatures encountered, we raised the change period to 60,000 miles, or approximately once a year. Our overhaul periods were stretched from 50,000 to 100,000 miles, and repair parts bill cut 50% with the increased mileage."

THE GLOBE COMPANY says:

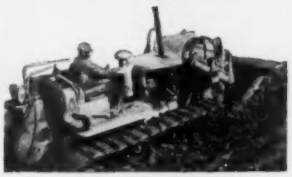
"THIS LUBRICANT INCREASED BEARING LIFE FROM 2 WEEKS TO 2 YEARS"

"After we had quite a few of our large high speed ROTO-CUT meat cutting machines in actual production operation, the ball and spherical roller bearings on the cutter shaft gave us serious trouble due to a condition that prevails throughout the meat packing industry, animal acids and moisture. Some bearings did not last even two weeks. Then, BALL BEARING LUBRIPLATE was called to our attention. The result: these machines lubricated with BALL BEARING LUBRIPLATE have been in continuous operation for over two years without a single bearing replacement.

The Globe Company
Frank J. Bilek (Chief Engineer)

"THIS LUBRICANT kept 'em rolling in mud, muck and water"

– says J. O. ARCHIBALD of Redwood City, California



"Due to our success on similar work, The Leslie Salt Company gave us the contract for the conversion of 500 acres of salt marsh into crystallizing ponds. Knowing from experience that LUBRIPLATE No. 107 reduced friction to a minimum, and prevented rust even in salt water, we adopted it for track and general lubrication. We selected LUBRIPLATE APG-140 for all transmissions and final drives. The effectiveness of LUBRIPLATE is evidenced by the fact that during the entire job there were no replacements of track rollers nor were there any tie-ups of equipment due to replacement or breakage."

J. O. Archibald

REGARDLESS OF TYPE AND SIZE OF YOUR MACHINERY LUBRIPLATE LUBRICANTS IMPROVE OPERATION AND GREATLY REDUCE MAINTENANCE COSTS.

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DEALERS FROM COAST TO COAST—SEE YOUR CLASSIFIED TELEPHONE BOOK

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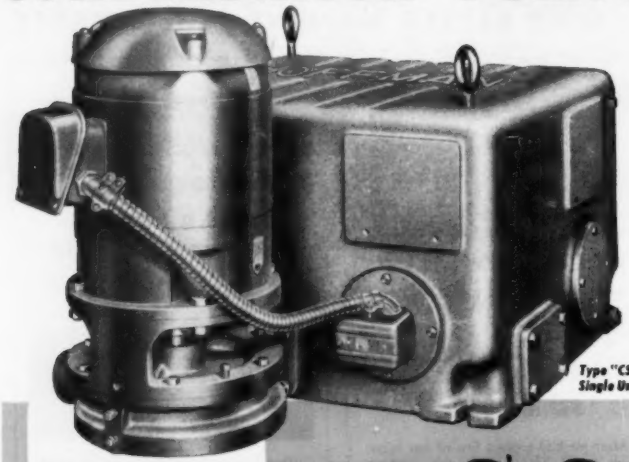
CONDENSATION PUMPS

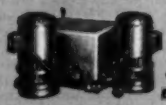


Type "CS" Single Unit

THESE FEATURES ASSURE YOU THE MOST MODERN PUMP AVAILABLE

1 Bronze fitted throughout.
2 Enclosed, precision balanced bronze impeller.
3 Stainless steel impeller hub.
4 Renewable bronze wearing ring.
5 Split bronze packing gland.
6 Drain plug for impeller casing.
7 Standard ball bearing motor, 40°C continuous duty, with ample overload capacity.
8 Heavy cast iron receiver.
9 Heavy duty float control, seamless copper float and brass rod.
10 Impeller has top suction inlet—eliminates air or vapor binding.
11 No piping between pump and receiver.
12 Float switch adjustable to various water levels.
13 Rigid motor support, very quiet.
14 Threaded outlet on pump cover to provide drainage and eliminate base with drip lip.

Hoffman, an old name on pumps, is proud to present a completely NEW line of Close-Coupled Condensation Pumps in single and duplex units!



Type "CD" Duplex Unit

Not only are these compact Hoffman Pumps recognized as highly efficient units, but they have design features which amazingly prolong service life, at low upkeep cost. They are so constructed that all parts subject to wear can be easily renewed. All cast iron and bronze construction.

Series "CS" and "CD" Pump capacities range from 1,000 to 150,000 sq. ft. EDR. Discharge pressures range from 10 lbs. per sq. in. to 60 lbs. per sq. in.

All together, these pumps are a rare combination of sound design and excellent workmanship. Units are shipped ready for connecting to the system.

FOR SMALL SYSTEMS THE "WATCHMAN NO. WC 8-20" PUMP for low pressure heating systems. Rating: 500 to 8000 sq. ft. EDR. Pump Capacity: 12 gallons per min. Pressure: 20 lbs. per sq. in. at pump discharge. ½ HP Standard Home motors.

HOFFMAN SPECIALTY MFG. CORP., Dept. P-9, 1001 York St., Indianapolis 7, Ind.

Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems. Sold by leading wholesalers of Heating and Plumbing Equipment.

More TECHNICAL BRIEFS

Begins on page 166

waters, emphasizing methods that offer greatest promise for continuous application. *ASTM paper. No number.*

Metals and Materials

Exploratory Investigation of High-Temperature Sheet Materials. *By D Preston, General Electric Co.*

Current advances in design of aircraft gas turbines place great emphasis on development and application of sheet metal structural parts. Metallurgical and design problems have long been encountered in combustion and exhaust systems of the conventional engine. With the recent innovation of the reheat system and advent of the hollow fabricated bucket, performance of sheet metal parts may well be the limiting factor in engine service life.

Most available high-temperature data has been recorded on bar-shaped materials. In view of the increasing need for similar information on sheet material, the Aviation Panel of the ASTM-ASME Joint Committee sponsored a program on effects of temperature on properties of metals, under Project AP-2.

This project recognizes the shortcoming of evaluating materials for aircraft gas turbines from limited strength data. It is well known that you must consider fabrication, corrosion, and thermal characteristics, and that prior to acceptance a material must undergo repeated and prolonged service testing in the turbine unit itself. When sufficient conditions of operation have been known, however, laboratory tests have proved reliable indicators of performance. They can serve to eliminate many time-consuming engine tests. The purpose of this program, then, is to investigate a few mechanical properties of representative high temperature materials. *ASTM paper. No number.*

Fundamentals of Atmospheric Elements. *By B C Haynes, U. S. Weather Bureau.*

To provide some guidance on use of meteorological parameters in developing structure design, this paper outlines methods of measuring atmospheric elements. It also discusses variations that may be expected when the basic data are observed from a standard weather station.

Variations in weather elements from day to day, month to month, and even year to year, require careful consideration when weathering tests are conducted. Test period weather records

Directions for ordering papers on p 152

Pressure-Seal Cast Steel Gate Valve

Small Cast Steel Angle and Y-Globe Valves for high-pressure service

Walseal Bronze Strainer

Walseal Bronze Globe Valve

Walseal Bronze Elbow

Walseal Bronze Union End Tee

Walworth is proud to be aboard the S. S. United States

When the United States Lines, the Newport News Shipbuilding & Dry Dock Company, and Gibbs & Cox, Inc., naval architects, join forces to build the fastest, safest and most modern liner the world has ever seen, the selected materials and components have to be top quality. Walworth Pressure-Seal Cast Steel Gate, Globe, and Angle Valves, and Walworth Small Cast Steel Angle and Y-Globe Valves for high-pressure service are installed in the main steam lines of the S. S. United States. Brass and copper lines use large numbers of Walseal valves, fittings, strainers, and unions.

Knowing that Walworth valves and fittings are a vital part of the power arteries aboard this great ship, the proudest moment of Walworth's 110 years of manufacturing experience came when the new Queen of the Sea broke both the east and west trans-Atlantic speed records.

As we present our compliments to Commodore Manning and his crew, to the Newport News Shipbuilding & Dry Dock Company and its men, and to William F. Gibbs and his staff, we also compliment the men and women of the Walworth Company who gave of themselves to put quality into our products and this quality ship.

WALWORTH

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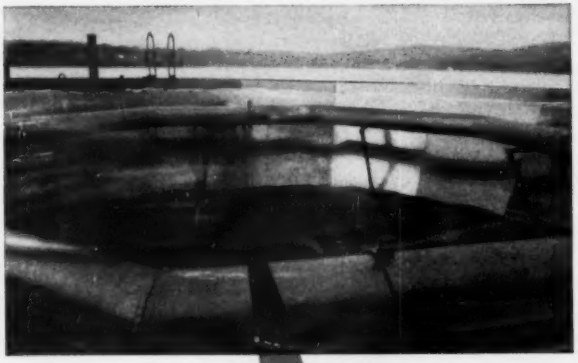
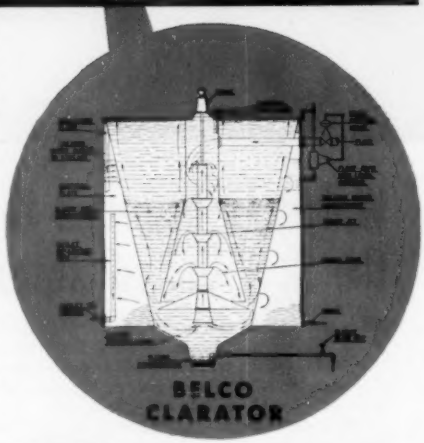
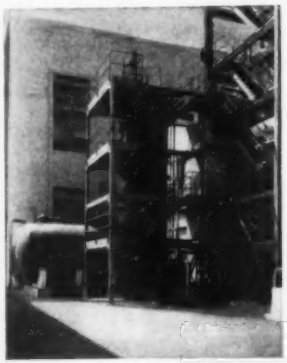
PROCESSES FOR REMOVAL OF WATER IMPURITIES

BELCO Clarator produces multiple savings for a Utility



The Clarator has multiple uses — clarification, stabilization, neutralization, chlorination, purification, alkalinity reduction, softening, silica removal, iron removal, controlled conditioning. The type and quantities of the chemicals used determine the final quality of the treated liquid effluent. Complete description and illustrations in Bulletin 108. Write for your copy.





Hot Process Softeners

Belco hot process softener settling tank and chemical feed equipment for high pressure boilers in southwest utility power house. The superior results of this type equipment have been proven in numerous installations.

Ask the Belco man!

★ We invite your consultation regarding all water conditioning requirements. Get acquainted with our organization for authoritative assistance and close cooperation. Write for late descriptive bulletins.

Belco

Belco Industrial Equipment Division, Inc.
PATERSON 3, NEW JERSEY

More TECHNICAL BRIEFS

Begins on page 166

should be compared with area means obtained from climatological records and the tests evaluated accordingly.

Exposed materials are affected by solar radiation, terrestrial radiation, air temperature, humidity, precipitation, wind, and atmospheric impurities.

For example, the time rate at which solar radiant energy is received on a unit area of horizontal surface is called the insolation. At the earth's surface, it depends upon (1) the solar constant; (2) inclination of the incident rays to the horizontal as determined by latitude, time of year, and time of day; (3) depletion to which the radiation has been subjected in passing through the atmosphere; and (4) to a slight extent upon variation in distance between earth and sun. *ASTM paper. No number.*

More POWER NEWS

Begins on page 164

ASTM Elects New Officers

New officers of the American Society for Testing Materials were announced at the 50th anniversary meeting in New York City, June 23-27. They are:

President, term one year, Dr Harold Lee Maxwell, supervisor of mechanical engineering consultants, E I Dupont de Nemours & Co, Inc; vice-president, term two years, Norman L Mochel, manager, metallurgical engineering, Lester, Pa. branch, Westinghouse Electric Corp.

Members of the board of directors, term three years, are George R Gohn, supervisor creep and fatigue laboratories, Bell Telephone Laboratories; Wm H Lutz, technical director, Pratt & Lambert, Inc; Howard K Nason, research director, organic chemicals division, Monsanto Chemical Co; Adolph O Schaefer, vice-president in charge of engineering and manufacturing, The Midvale Co; Myron A Swayze, director of research, Lone Star Cement Corp.

ISO Committee Discusses Use of Preferred Numbers

A committee of the International Organization for Standardization (ISO) discussed practical use of preferred numbers at a meeting in New York June 9 and 10. The French national standards body submitted the main proposal—a guide for use of preferred numbers in the mechanical industry.

They recommended using preferred numbers in developing specifications or standards for industrial products, operations and processes, unless there is a valid reason for adopting other values. The numbers have already been unified internationally. They can be used for length, cubic contents, capacity of prime movers, or any performance or quality characteristic. Since they

AT FLORI—A SYMBOL OF SERVICE!

The FLORI BONANZA—a trim executive airplane with a 775 mile cruising range—symbolizes the FLORI approach to customer service. No customer is too distant, isolated, large or small to command the FLORI BONANZA out of its hangar and into the air with a Flori Pipe Co. sales engineer aboard.

This progressive approach to customer satisfaction is reflected throughout the entire FLORI operation in terms of service, equipment, performance and business integrity. Orders large and small are given equal attention. FLORI fabrication facilities are of the newest design, including the most recent ultra-sonic equipment for weld inspection. FLORI "standards" have set an industry pattern for quality; FLORI management and supervisory personnel represent a total of several hundred years experience in the power piping field.

A special emphasis is placed upon the fabrication of high temperature, high pressure alloy piping for modern power plants. FLORI'S quality control program, combined with critical production techniques, ensures leading performance in the field of power piping fabrication.

IF IT'S PIPING—CONTACT FLORI

FOR YOUR LITERATURE FILES

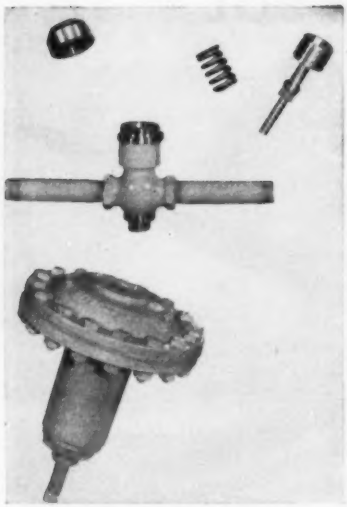
Detailed literature covering FLORI facilities and operations is available from Dep't O, c/o

THE FLORI PIPE COMPANY

601 E. RED BUD AVE., ST. LOUIS 15, MO.

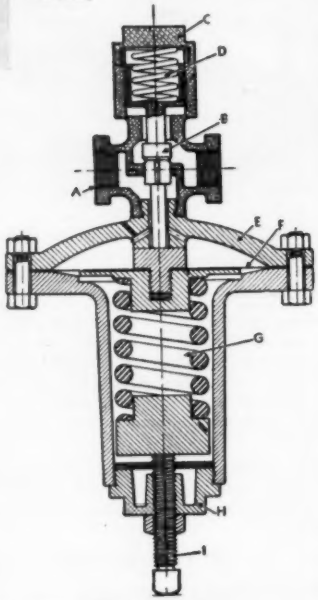
CHICAGO BRANCH: 3915 W. ARMITAGE, CHICAGO 47, ILL.

Simplify Valve Maintenance!



Specify Stickle Reducing Valves. Re-grind the Valve—Replace the Diaphragm —*Without Tearing Down The Line!*

No need to tear down the line to inspect or service this Stickle Spring Balanced Reducing Valve! You can get at any individual part *without removing valve body from the line.* Valve is *not* attached to diaphragm—can be separated easily. Entire diaphragm case is also quickly detachable. (See exploded view, at left.)



APPLICATION

Stickle Spring Balanced Reducing Valves are available in three sizes—½", ¾", and 1". Each proves exceptionally satisfactory for any standard service on water, steam, or air. *Results are guaranteed* in advance of installation, on a full, money-back basis.

OPERATION

Reduced pressure is connected to "A" and is in direct contact downward with diaphragm "F" through internal port, thereby keeping diaphragm water sealed at all times. Spring "D," plus initial pressure on top of valve, assures positive closing against dead end. Tension in spring "G" is changed by set-screw "I" at bottom, to obtain variation in pressure reduction. For additional facts, send for free bulletin, below.

STICKLE STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

FREE! *Get all the illustrated facts about cost-cutting Stickle Valves. Send for Bulletins 235, 255, and 435. No obligation, of course!*

More POWER NEWS

Begins on page 164

are independent of the unit of measurement, they are handled the same way in metric countries as in inch countries.

Preferred numbers have two major uses: (1) They simplify selection of standard values from an excessive variety of existing values. (2) They can be used to lay out a rational series of values as the framework of standardization where details still have to be developed.

National Standards bodies working on the preferred numbers project are from Austria, Belgium, Brazil, Czechoslovakia, Denmark, Finland, France, Germany, Hungary, India, Italy, Netherlands, Norway, Poland, Portugal, Sweden, Switzerland, the United Kingdom, the United States, and the U.S.S.R.

Coming Events

Sept 8-12—Seventh National Instrument Conference and Exhibit, Public Auditorium, Cleveland, Ohio. Instrument Society of America, 1319 Allegheny Ave, Pittsburgh 33, Pa. and the Industrial Instrument and Regulator Div of the ASME, 29 W 39th St, New York 18, N. Y.

Sept 9-13—Seventh National Chemical Exposition, Coliseum, Chicago, Ill. Chicago Section, American Chemical Society, 86 E Randolph St, Chicago 1, Ill.

Sept 11-12—Centennial of Engineering, Chicago, Ill. Energy Symposium sponsored by ASME, 29 W 39th St, New York 18, N. Y.

Sept 18-19—East Central Section, APSPAA, Kentucky Hotel, Louisville, Ky. Acting chairman, R W Bourne, chief engr, Louisville Air Pollution Control Commission, Room 304, City Hall, Louisville, Ky.

Sept 22-24—Petroleum Div, ASME, Hotel President, Kansas City, Mo. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

Oct 13-16—Engineering Conference, Technical Assn, Pulp and Paper Industry, Morrison Hotel, Chicago, Ill. R G MacDonald, secy, TAPPI, 122 E 42nd St, New York 17, N. Y.

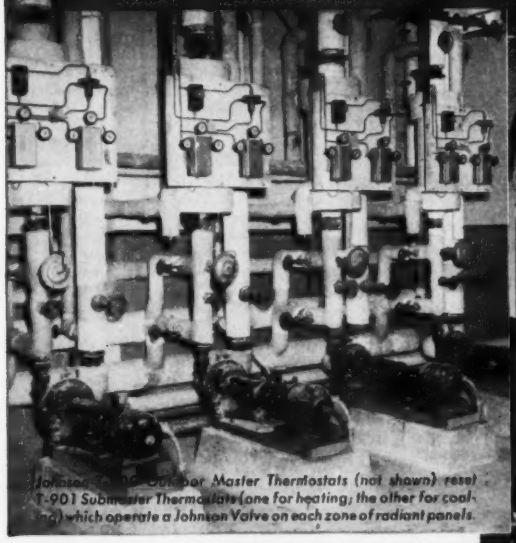
Oct 19-24—Annual Meeting American Welding Society, Bellevue-Stratford Hotel, Philadelphia, Pa. J G Magrath, secy, AWS, 33 W 39th St, New York 18, N. Y.

Oct 30-31—Fifteenth Joint Meeting, ASME Fuels Div, American Institute of Mining Engrs, Philadelphia, Pa. O B Schier, meeting chairman, ASME, 29 W 39th St, New York 18, N. Y.

Oil Piped Across U.S.-Canada Border

The Interprovincial-Lakehead Pipe Line is the first to carry Canadian oil across the U.S. border. It takes crude oil 1137 miles from the Alberta oil fields to Superior, Wis.

JOHNSON CONTROL



Johnson T-900 Outdoor Master Thermostats (not shown) reset T-901 Submaster Thermostats (one for heating; the other for cooling) which operate a Johnson Valve on each zone of radiant panels.

Head Office, Dominion Textile Company, Ltd., Montreal, Quebec. H. Ross Wiggs, A.R.C.A., architect, Montreal; Wiggs, Walford, Frost & Lindsay, consulting engineers, Montreal & Toronto; Connolly & Twizell, Ltd., heating contractors; W. E. Baxter, Ltd., ventilating & air conditioning contractors, both of Montreal.

Dominion Textile Company, Ltd., describing the heating and air conditioning system for its new head office building, Montreal, in a fine brochure entitled "A BUILDING AND A BUSINESS", says that "Guarding this intricate heating-cooling mechanism is an array of thermostatic controls both inside and outside the building." And, the "array" to which reference is made is a 'planned-for-the-purpose" Johnson System of automatic temperature and humidity control.

"In many ways, "the booklet states, "the new head office is one of the most modern office buildings on the continent. Its heating and air conditioning system is a fine example of engineering skill. In one combined operation, a variety of equipment provides air heating, air cooling and ventilation. Temperature control is effected in two ways; about 25 per cent of it by means of radiant heating (aluminum panels having copper piping in the walls below the windows) and the balance by temperature of the air in the ventilating system. These radiant 'heating' panels, incidentally, become 'cooling' panels in summer as cold water is circulated through them . . . Control of humidity is also a major job . . . "

Yes! There is quite an array of Johnson equipment in this interesting installation, applied to the radiant panels and to the 12 year-'round air conditioning systems which make Dominion Textile's head office the largest completely air conditioned building in Montreal. Moreover, it is the only building in Canada employing radiant *cooling* panels. Johnson T-900 Master Thermostats are an integral part of the automatic control apparatus. They measure outdoor temperatures and reset the Johnson T-901 Submaster Thermostats which, in turn, operate Johnson modulating Valves and Dampers on the heating and air conditioning systems.

Whether *your* problem demands an intricate control system or a very simple arrangement of thermostats and valves or dampers, ask a nearby Johnson engineer. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

Niagara's HYGROL DRIES AIR BEST

with exact moisture content

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

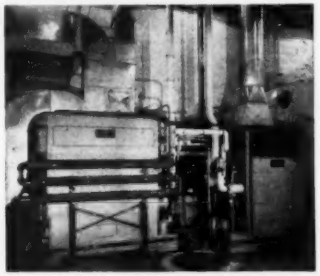
Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



Niagara Controlled Humidity Air Conditioning

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

For complete information write

NIAGARA BLOWER COMPANY

Dept. P, 405 Lexington Ave., New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

More POWER NEWS

Begins on page 164

From there lake tankers take the oil to Canadian refineries in eastern Ontario.

The system is unusual not only for the international agreements worked out, but also for the identical equipment used on both sides of the border. Each station has diesel pumping engines that were designed by the American Locomotive Co. Engines in the U.S. section were built at Auburn, N. Y. Canadian ones are from Dominion Engineering Works of Montreal under a licensing agreement.

These diesels are standard 12½- by 13-in units, similar to the ones used for locomotive service. They are either 6 or 8 cylinder, dual-fuel or straight diesel engines. The injection equipment is special, and the pistons are of cast iron, but all other parts are standard.

The centrifugal pumps are driven through step-up gears with a ratio of 6 to 1. Dominion Engineering furnished the Canadian gears, Farrel-Birmingham the American ones. The main line pumps are Byron-Jackson design, furnished by the Canadian licensee and by Bingham Pump Co.

There are nine stations in Canada and two in this country, with a third under construction. Each station has either two, three or four pumping units connected in series. They are all similar, even to the emergency shut-down device for operation from outside the building.

Station capacity must be variable from 40,000 bbl per day in the winter, ultimately up to 135,000 bbl per day in the summer. The pipeline operates on the closed-line system, and its flow is automatically controlled by the pumping rate of the Edmonton, Alberta, station.

General Electric Co submitted a low bid of $7,763,755 to the Corps of Engineers at Walla Walla, Wash, for installing four 73,684 kva generators at the McNary Dam powerhouse.

Plans for producing expanded commercial quantities of *KEL-F*, strategic fluorocarbon type plastic with extraordinary resistance to heat, moisture and chemical action, were announced recently. Warren L Smith, president of the **M W Kellogg Co,** subsidiary of Pullman, Inc, said that new production facilities, initially costing about $1,000,000, are under construction at Jersey City, N.J. This is the development and manufacturing center of Kellogg, designers and builders of petroleum and chemical processing plants. Scheduled to go into operation before the end of the year, the new plant will enable Kellogg to meet "increasing demands for *KEL-F* for military and industrial purposes."

Largest steam-electric plant in California will have 800,000 hp capacity. It is an open-air-design plant now being built by **Pacific Gas and Electric Co** at Pittsburg, with four generating units rated at 150,000 kw each. Boilers will be 15 stories high, stacks 200 ft high, 18 ft in diameter. Initial power output is scheduled for late 1953.

This Mead-Morrison Unloader features a gearless hoist (slow speed motor coupled direct to drum shaft) and variable voltage control.

SPEEDY unloading SIMPLE operation

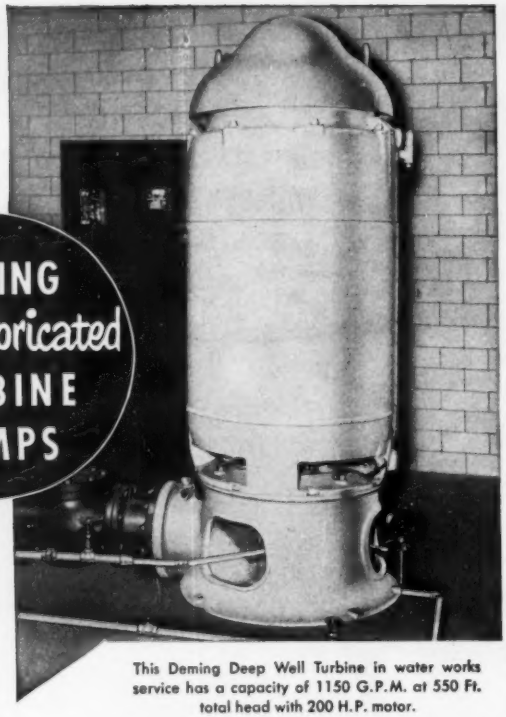
Typical of Mead-Morrison Rigs

The illustration shows a 6-ton Mead-Morrison coal unloader on the Ohio River . . . one of the many Mead-Morrison rigs that are making records for speedy, economical, dependable operation at steel mills and power plants.

The rapid unloading of river coal barges is further aided by Mead-Morrison barge haul machines. Our engineers will be glad to help you plan your new unloading facilities or give you information for increasing the capacity of your present equipment.

MEAD-MORRISON

DIVISION OF McKIERNAN-TERRY CORPORATION · MANUFACTURING ENGINEERS · HARRISON, N. J.



DEMING
Water Lubricated
TURBINE
PUMPS

This Deming Deep Well Turbine in water works service has a capacity of 1150 G.P.M. at 550 Ft. total head with 200 H.P. motor.

Adaptable TO A WIDE RANGE OF APPLICATIONS

There are three principal components in Deming Vertical Turbine pumps. These are the Drive Assembly, the Column and Shaft Assembly, and the Bowl Assembly.

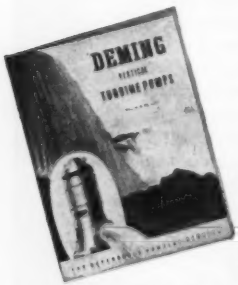
Those three principal components are manufactured in a wide range of standard sizes for quick assembly into almost unlimited combinations to meet specific conditions.

Unit drive head is furnished where electric power is available. Auxiliary drives are available to meet various requirements.

Pumps are designed for wells 4" to 16" or larger in a full range of capacities from 15 to over 3500 G.P.M.

For dependable, low cost operation and maintenance in water works pumping service, *Specify Deming Vertical Turbine Pumps.*

THE DEMING COMPANY • 547 Broadway • Salem, Ohio



Write for Bulletin No. 4700 which gives you detailed information about Deming Vertical Turbine Pumps.

Deming
DEPENDABLE PUMPS

More FREE BULLETINS

Begins on page 179

B14 **DEAD-ENDS**—*Preformed* units for conductors, ground strand, guy wires, service drops. Develop full strength without concentrated pressures. 8-page bulletin 35-200. Preformed Line Products Co, 5349 St Clair Ave, Cleveland 3, Ohio.

B15 **WIRED TELEVISION** — For industrial installations. Model 300-B *Utiliscope* includes camera, power unit, viewing unit. 4-page bulletin 1025-A gives photos, uses. Diamond Power Specialty Corp, Lancaster, Ohio.

B16 **ELECTRICAL CRANE EQUIPMENT**—Motors, brakes, controllers, protective panels, limit switches, current collectors. 32-page bulletin C5-1 gives photos, charts. Harnischfeger Corp, Overhead Crane Div, Milwaukee 46, Wis.

B17 **FLOAT BATTERIES** — Single-page instruction sheet describes effect of antimony on float batteries, shows curve of self-discharge rate vs % of battery life. Gould-National Batteries, Inc, Trenton 7, N.J.

HEAT EXCHANGERS

B18 **INSTANTANEOUS HEATERS** — Hot water units, 2, 4, and 6 pass, capacities from 2 to 425 gpm. 56-page bulletin 35-78 gives capacity tables for 198 heaters, illustrations, descriptions, prices. American District Steam Co, Inc, North Tonawanda, N.Y.

B19 **CONVERTORS**—Water-tube type, 2 and 4 pass, provide hot water for space heating. 32-page bulletin 35-77 lists capacities and pressure drops for 148 convertors at 7 steam pressures, gives applications, dimensions, weights, prices. American District Steam Co, Inc, North Tonawanda, N.Y.

B20 **HEAT TRANSFER EQUIPMENT** —Photo presentation of heaters, coolers, condensers, heat exchangers for all types of liquids, vapors, and gases. 8-page progress issue of *G-R News* gives brief descriptions. Griscom-Russell Co, Dept A, Massillon, Ohio.

B21 **SUPERCHARGER AIR INTERCOOLERS** — For cooling compressed air between supercharger blower and air manifold of diesel, gas, dual fuel, etc, engine. High and low pressure systems, tube and fin coolers. 4-page catalog 1652. Young Radiator Co, Racine, Wis.

MAINTENANCE MATERIALS

B22 **GENERAL-PURPOSE PACKING** —*Durametallic* and *Dura Plastic* spiral packings in *Handy Pack* carton meet average stuffing box requirements. 4-page bulletin 443 gives photos, installations, specifications. Durametallic Corp, 2104 Factory St, Kalamazoo 24F, Mich.

B23 **PRECISION O-RINGS**—Temperature resistant type for service from —100 to + 500 F, in non-moving seal applications. 4-page catalog 5160A1 gives complete data and dimensions. Parker Appliance Co, 17325 Euclid Ave, Cleveland 12, Ohio.

B24 **HYDRAULIC PACKING** — Single and two-lip types for heavy-duty oil and water service. 8-page bulletin gives construction, dimensions, service recommendations. James Walker Packing Co, Inc, 96 Liberty St, New York 6, N.Y.

B25 **CABLE REEL JACKS**—For lifting and holding heavy reels from 20 to 90 in. diameter; capacities 5 to 15 tons. 2-page bulletin AD-26 gives photos, specifications. Duff-Norton Mfg Co, Pittsburgh 30, Pa.

B26 **HEAT-RESISTING PAINT**—Aluminum paint withstands temperatures to 1700 F, air dries on cold surfaces in 30 min. 4-page bulletin 112351 gives uses, methods of application. Speco, Inc, 7308 Associate Ave, Cleveland 9, Ohio.

B27 **WATER REPELLENT**—Silicone-base type for brick, concrete, sandstone, limestone, stucco, etc, surfaces. 4-page bulletin describes advantages, action of *Flexseal* coating. Flexrock Co, Building Maintenance Div, 36th & Filbert Sts, Philadelphia 4, Pa.

ANKORFLEX

. . . so versatile it can be used for largest hydraulic plungers down to smallest valve stems.

BRANCHES

BOSTON, MASS. • NEW YORK, N. Y.
CHICAGO, ILL. • PHILADELPHIA, PA.
DETROIT, MICH. • PITTSBURGH, PA.
LOS ANGELES, CAL. • ST. LOUIS, MO.
NEW ORLEANS, LA. • SEATTLE, WASH.
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Ankorflex packings impose minimum friction and result in decreased power consumption and longer packing life.

Ankorflex is a sturdy, self-acting lip packing designed especially for use on hydraulic rods and plungers and against high and low pressures. Also extensively used on outside packed rods, rams and plungers.

This packing, while responding to pressure, at no time distorts under pressure of the liquid.

Rings are cut diagonally. However, if endless rings are desired, please so specify.

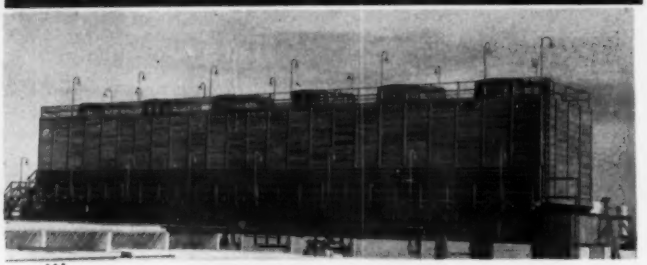
THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE

UNITED Builds Dependable Towers
for All Water Cooling Purposes



United tower in oil refinery service

Mechanical Draft Towers featuring low pressure, closed system water distribution, redwood interiors and effective counterflow cooling over large deck surfaces.

Atmospheric Deck Type Towers of redwood throughout, with closed low pressure distribution through sprinklers or spray nozzles.

"Package" Type Towers of steel or wood, mechanical or natural draft, in 3 to 15 tons capacity.

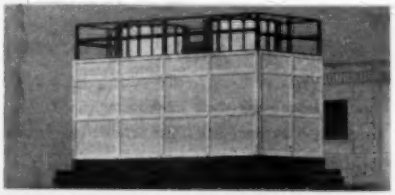
Bulletin No. 50 gives full details. Yours upon request.

UNITED COOLING TOWER CO.

4022 Broadway, Kansas City 2, Mo. Plant: Pilot Point, Texas

Authorized Representatives in Principal Cities

United compressor plant installation



United air conditioning tower, large public bldg.

UNITED COOLING TOWERS

More FREE BULLETINS

Begins on page 179

faces. 4-page bulletin describes advantages, action of *Flexrock* coating. Flexrock Co, Building Maintenance Div, 36th & Filbert Sts, Philadelphia 4, Pa.

MATERIALS HANDLING

B28 **CONVEYOR BELTING**—*Tread-Top* for carrying articles up or down 25- to 30-deg inclines. 4-page bulletin gives specifications, uses. Baldwin Belting, Inc, 76 Murray St, New York 7, N.Y.

B29 **VERTICAL TRANSPORTATION**—Passenger elevator cars and entrances; escalators; freight elevators and doors; elevator service. 24-page bulletin 382 is practical guide to selecting proper vertical transportation for passenger or freight service. Illustrated. Otis Elevator Co, 260 Eleventh Ave, New York 1, N.Y.

B30 **HINTS FOR BETTER ELEVATORING**—Discusses fundamentals of vertical transportation in offices, stores, apartments, hospitals, hotels, industry. Practical 32-page bulletin 398. Illustrated. Otis Elevator Co, 260 Eleventh Ave, New York 1, N.Y.

B31 **CRUSHERS**—Handbook explains various crushing methods and where they apply in crushing procedure. Non-technical 12-page bulletin to assist "the man who, sometime, may want to select a crusher." Illustrated. Pennsylvania Crusher Co, 1700 Liberty Trust Bldg, Philadelphia 7, Pa.

B32 **TRACTORS**—D4 diesel units, 43 drawbar hp. 32-page catalog form 30291 shows construction, pictures each part, explains performance. Caterpillar Tractor Co, Peoria, Ill.

MECHANICAL TRANSMISSION

B33 **ROLLER CHAIN**—And sprocket wheels. 148-page book 2457 has detailed information on selection, installation, lubrication, maintenance, gives design, selection data, formulas, charts, diagrams, photos, drawings. Also lists stock drives, attachments, tighteners, etc. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

B34 **GEARS** — For industrial, farm and construction machinery. 4-page folder shows applications. Specification sheets available for complete line. Snow-Nabstedt Gear Corp, 222 Welton St, Hamden, Conn.

B35 **CYLINDERS**—Hydraulic- and air-operated types, for low and high pressure operation. 6-page folder illustrates 16 cylinder-powered movements, shows 21 actual application photos. Hanna Engineering Works, 1765 Elston Ave, Chicago 22, Ill.

METERS AND INSTRUMENTS

B36 **GAGES AND THERMOMETERS**—For industrial use. Altitude, ammonia, combination, compound, duplex, pressure, vacuum, etc, gages, also accessories. 80-page catalog 76-1 gives details of operation, specifications, dimensions, selection data. Jas P Marsh Corp, Skokie, Ill.

B37 **ELECTRONIC FLOW METER**—*Potter-Brown* unit measures flow over wide range of temperatures and pressures with accuracy of ½%. System has linear characteristics, can be used for foods, chemical compounds, strong caustics. 4-page instrumentation data sheet 10.3-5 gives photos, description. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Station 213, Wayne & Windrim Aves, Philadelphia 44, Pa.

B38 **INDICATING POTENTIOMETERS**—Precision, self-balancing units for single and multi-point indication; also console type operator's desk. 4-page specification sheet 177 gives dimensions, ordering information. Minneapolis - Honeywell Regulator Co, Brown Instruments Div, Station 40, Wayne & Windrim Aves, Philadelphia 44, Pa.

B39 **TACHOMETER KITS** — For recording and controlling produc-

Check List

for selecting a Piping Contractor

Listed below are a number of important factors that should be taken into account whenever you select a piping contractor. If any of these are overlooked, you are not buying your piping construction to best advantage.

☐ **EXTENSIVE SIMILAR EXPERIENCE** • Is the contractor thoroughly experienced on your type of work? Problems are always more readily solved when they have been met before.

☐ **MODERN FABRICATING PLANTS** • Fully equipped plants staffed by piping experts make practical piping subassemblies that are correctly planned and prefabricated to simplify and expedite field erection.

☐ **PROGRESSIVE ORGANIZATION** • You want a contractor who keeps abreast of new piping developments. Piping research on a continuous basis should be his policy.

☐ **CONVENIENT LOCATION** • A fabricating plant near enough to give you quick service is of prime importance. Convenient location also improves overall supervision of the job.

☐ **SUPERIOR FIELD FACILITIES** • A job of any size needs a resident superintendent with a permanent staff of supervising erectors. Welders should be qualified on your materials.

☐ **PLUS SERVICES** • The experienced contractor often can make suggestions that result in improved piping design and savings in time and money.

4586

You can check all these when you select MIDWEST

MIDWEST PIPING SERVICE IS NATION-WIDE

4 Plants Are Better Than 1

PIPING FABRICATORS AND CONTRACTORS

MIDWEST PIPING & SUPPLY CO., INC.
Main Office: 1450 South Second Street, St. Louis 4, Mo.
Plants in St. Louis, Passaic, Los Angeles and Boston
Sales Offices: New York 7—50 Church St. • Chicago 3—79 West Monroe St.
Los Angeles 23—520 Anderson St. • Houston 2—1213 Capitol Ave.
Tulsa 3—334 Wright Bldg. • Boston 07—426 First St.

. . . NEW Heat Saving Efficiency

MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks. *Write for new heat insulation Engineering & Specification Data Manual.*

Mundet Cork Corporation

Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

Mundet district offices are located in these cities:

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KNOXVILLE 1221 Second Ave.
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NEW YORK 17 331 Madison Ave.
PHILADELPHIA 39 834 N. 40th St.
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WASHINGTON, D. C. 600 F Street, N.W.

In Canada: Mundet Cork & Insulation, Ltd., 33 Booth Ave., Toronto

INSULATION FOR HIGH & LOW TEMPERATURE

More FREE BULLETINS

Begins on page 179

tion. Kit contains tachometer generator, indicator, recorder, and web-break detector if required. 4-page bulletin GEC-816 gives applications, prices, dimensions. General Electric Co, Schenectady 5, N.Y.

B40 HAND TACHOMETERS—One- to five-range mechanical hand units and single-range chronometric speed indicators. 2-page bulletin 12AA gives photos, descriptions. Associated Research, Inc, 3758 W Belmont Ave, Chicago 18, Ill.

B41 INSTRUMENT CALIBRATOR—Portable pneumatic unit calibrates and tests low-pressure instruments like flow meters, draft gages, differential pressure transmitters with ranges 0 to 20 in. water, pressure, vacuum, or compound. 4-page bulletin 52-3 gives features, operation, photos. Republic Flow Meters Co, 2240 Diversey Parkway, Chicago 47, Ill.

B42 WELDING ANALYZER—Records current, electrode force, etc, for single and 3-phase resistance welding. 2-page catalog on Model BL-213 gives specifications. Brush Development Co, Instruments Div, 55F, 3405 Perkins Ave, Cleveland 14, Ohio.

PIPING, VALVES, FITTINGS AND SPECIALTIES

B43 STEAM TRAPS—Cast semi-steel and forged steel inverted bucket types, also compound, ball float and air relief traps. 44-page catalog J explains how to calculate condensate loads, select traps, maintain installations. Photos, diagrams, ordering information. Armstrong Machine Works, Three Rivers, Mich.

★ **INDUSTRIAL SPRAY NOZZLES**—For cooling ponds, cooling towers, industrial processes. 40-page bulletin 5200 gives dimensions, capacities, spray angles. Illustrations, operation, construction, applications. ★Request direct, not from POWER. Binks Mfg Co, 3122 Carroll Ave, Chicago 12, Ill.

B44 CHECK VALVES — Hydraulic, double-cushioned type. 2-page bulletin WS-1 gives details, application, construction, parts list. Golden-Anderson Valve Specialty Co, 2070 Keenan Bldg, Pittsburgh 22, Pa.

B45 EXPANSION JOINTS — Corrugated, free-flexing, controlled-flexing, and high - pressure types. 8-page bulletin CMH-119R gives dimensions, design, installations. Flexonics Corp, 1301 S Third Ave, Maywood, Ill.

B46 SLIP-ON FITTINGS — Rail type; eliminate threading or welding and save on cutting pipe. For standard pipe in sizes ¾ to 2 in., aluminum, brass, galvanized or black steel. 8-page bulletin 139 gives uses, specifications, dimensions, photos. Hollaender Mfg Co, 3841 Spring Grove Ave, Cincinnati 23, Ohio.

B47 FILTERS—For microscopic clarification of industrial liquids and various gases. 4-page condensed catalog PL-200 describes single- and multi-tube units, capacities 6 to 60,000 gph. Commercial Filters Corp, 18 W Third St, Boston 27, Mass.

PRIME MOVERS AND ACCESSORIES

B48 TURBINE BUCKETS — Standard series, integral shroud type, for one and two velocity-stage turbines and larger machines. One 4-page folder gives descriptions, features; second 4-page folder gives dimensions, diagrams. Schellens-True Corp, Ivoryton, Conn.

B49 STATIONARY DIESELS—*Superior* Models 60 and 80, 6- and 8-cylinder sizes, capacities from 410 to 1440 hp, for utilities, institutions, dredges, industry. 8-page bulletin 5201 gives design features, capacity tables, dimensions. National Supply Co, Springfield 99, Ohio.

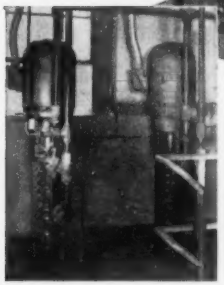
B50 STATIONARY DIESELS—*Superior* model 40, in 6 and 8 cylinder sizes, capacities 215 to 650 hp. 8-page bul-

this small, low-priced

BJ HYDROPLEX PUMP

is *engineered* for economical boiler feed service

- For medium pressure, medium temperature, low capacity pumping.
- Uniform, non-pulsating flow.
- Variable capacities without by-pass or speed change.
- Vertical construction—needs only a simple foundation and a minimum of floor space.
- No relief valves.
- Only one stuffingbox . . . and it is under suction pressure.
- Radial forces balanced at all loads by staggered volute construction.
- Axial thrust balanced by opposed grouping of impellers.
- Easily dismantled and reassembled.



THESE HYDROPLEX PUMPS provide 30 gpm of cold condensate at 435 psi. They are 10-stage units, driven by 25 hp motors at 3550 rpm.

IF YOUR PUMPING JOB involves a medium pressure, medium temperature, low capacity operation, the BJ Hydroplex can do it with quiet, smooth efficiency *and with less installation and maintenance cost*. This smaller, low-priced version of the highly successful BJ Hydropress centrifugal pump has a capacity range from 10 to 140 gpm at heads of 450 to 1700 feet. It operates at high speeds—3550 rpm on 60 cycle and 2950 on 50 cycle and higher in special units.

You'll find that this simple, dependable BJ Hydroplex has definite advantages over complex displacement type pumps. For full information, send the coupon now.

Byron Jackson Co.

Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

BJ PUMP DIVISION, DEPT. 27

Our problem is pumping _____ gpm of _____ at a head of _____ Tell me more about the BJ Hydroplex.

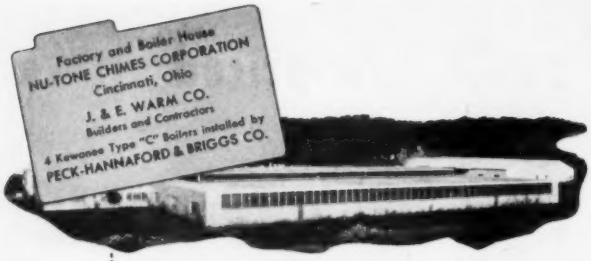
NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

No obligation, of course.


Factory and Boiler House
NU-TONE CHIMES CORPORATION
Cincinnati, Ohio
J. & E. WARM CO.
Builders and Contractors
4 Kewanee Type "C" Boilers installed by
PECK-HANNAFORD & BRIGGS CO.

Modern Factories Need the *EXTRA STEAMABILITY* of

KEWANEE

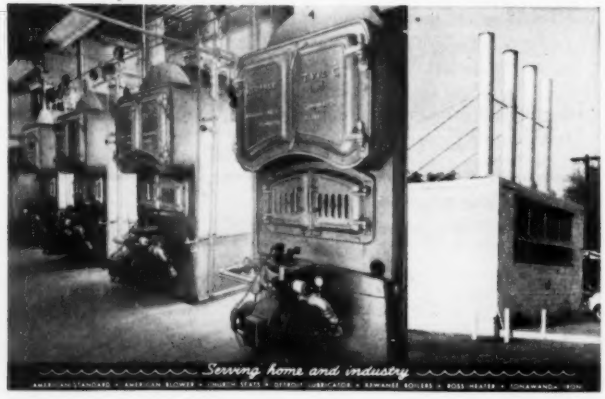
STEEL BOILERS

The design of modern factory buildings is undergoing a radical change . . . spreading out rather than going up . . . with greatly enlarged roof areas, many skylights and the walls largely windows.

While this modern construction provides better light and a smoother flow of materials through production lines it steps up steam requirements.

With 4 large Kewanees . . . total capacity of 25,000 square feet steam (5 million Btu) . . . the new plant of Nu-Tone Chimes can be sure of plenty of heat all over the building. And the ability of Kewanee Boilers to carry overloads of 50% and more, with high efficiency, provides an ample reserve to handle later plant expansion without additional boiler equipment.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS



More FREE BULLETINS

Begins on page 179

letin 5200 gives description, performance, specifications. National Supply Co, Springfield 99, Ohio.

B51 **STATIONARY DIESELS**—*Superior* model 65, in 6 and 8 cylinder sizes, capacities 580 to 1500 hp. 8-page bulletin 5202 gives design features, specifications, component parts. National Supply Co, Springfield 99, Ohio.

B52 **STANDBY POWER**—*Power Points* Vol. 8, No. 2, 24-pages, gives reports on standby installations in hospitals, schools, dairies, etc. Illustrated. D W Onan & Sons Inc, University Ave at 25th S E, Minneapolis 14, Minn.

PUMPS

B53 **PROPORTIONING PUMPS** — Mechanical drive "U" type metering and proportioning units for small volume flows, in batch of continuous operations. 20-page bulletin UP-52 gives specifications, prices, selection data, photos. Hills-McCanna Co, 2369 W Nelson St, Chicago 18, Ill.

B54 **CONTROLLABLE CAPACITY PUMPS**—*Power-Saver* units, plunger type, for medium- and high-pressure work, 11 to 100 bhp. 8-page data sheet 65A gives applications, design, operation, photos, cross-section diagrams. Aldrich Pump Co, Allentown, Pa.

B55 **PUMP VALVES** — Also packings, heaters. 22-page catalog SC-510 gives specifications, features of standard, lock-in, and deck-type reciprocating pump valves, *Simsite* graphitic packing rings, *HusHeaters*. Sims Pump Valve Co, Inc, 145 Hudson St, New York 13, N.Y.

B56 **CONTROLLED VOLUME PUMPS** —*Pulsafeeder* piston - diaphragm units, with no stuffing boxes. Capacities 1.6 to 339 gph. 24-page bulletin 300 gives cross-section diagrams, operation, specifications, dimensions. Lapp Insulator Co, Inc, Process Equipment Div, LeRoy, N.Y.

B57 **ROTARY PUMPS**—8-page bulletin WQ-50 describes *Warren-Quimby Rotex* pumps, gives sectional views, dimensions, selection data. Warren Steam Pump Co, Inc, Warren, Mass.

B58 **CENTRIFUGAL PUMP**—All-purpose unit, submersible, hermetically sealed. Capacity 1000 gph at zero head. 2-page bulletin on model P-104 gives specifications, design features, dimensions. Kenco, Inc, 1125 N Ridge Rd, Lorain, Ohio.

B59 **PUMP GUIDE**—Reference chart for small pump applications. Lists pumps, recommended service, performance characteristics, packing, mountings, features. Tuthill Pump Co, 939 E 95th St, Chicago 19, Ill.

B60 **HIGH-PRESSURE PUMPS**—Self-contained, package units, with integral drive motor, reduction gears, lube pump, scavenger pump, working pressure gage. 6-page bulletin gives operation, installation data of *Triplex* unit; photos, dimensions. Kobe Inc, Industrial Sales and Export Div, NBC Building, Cleveland, Ohio.

B61 **CONTROLLED VOLUME PUMPS** —Air operated: also automatic chemical feed systems. 24-page bulletin 351 gives construction, operation, application data, air consumption and capacity-pressure tables for pumps handling from 0.4 to 405 gph. Milton Roy Co, Mr J G Rimmer, 1300 E Mermaid Lane, Philadelphia 18, Pa.

WATER TREATMENT

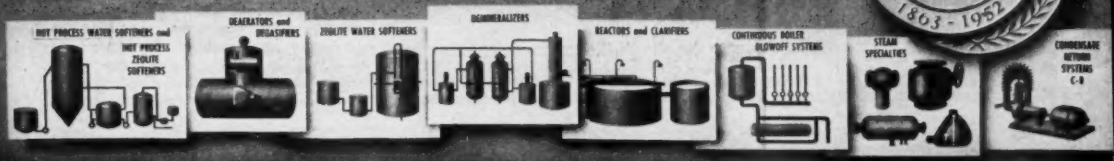
B62 **ZEOLITE SOFTENERS** — With *Cochrane* hydromatic single control valve. 32-page bulletin 4520-A explains operation, gives glossary of terms, layout and selection data. Photos, cutaway diagrams, charts. Cochrane Corp, Philadelphia 32, Pa.

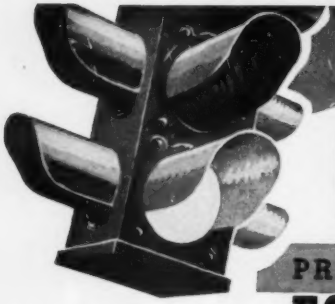
B63 **DEMINERALIZER** — *Mono - Bed* units mix anion and cation resins in a single unit tank. 2-page catalog sheet gives photos, parts, specifications, performance. Flow rates 10 to 1000 gph.

WATER
is
COCHRANE's
Major Business

COCHRANE CORPORATION
89
YEARS OF SERVICE
1863 - 1952

PIONEERS AND LEADERS IN BOILER FEED PROCESS & INDUSTRIAL WATER CONDITIONING

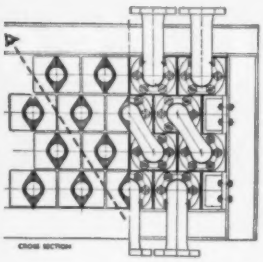




GREEN

PREMIER DIAMOND ECONOMIZERS

The Economizer with the "Diamond" Design



Here are the four major values in the "diamond" shape of the Green Fuel Economizer:

1... Streamline flow of flue gases gives minimum draft loss

2... Finned tubes give maximum heating surface in given space

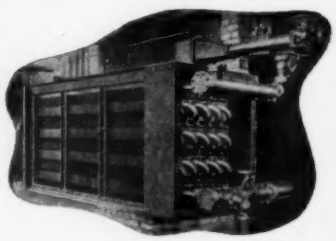
3... Staggered tube arrangement permits easy inspection

4... Minimum soot collecting surface is thoroughly cleaned by Green's "Special" Soot Blowers

Green Premier Diamond Economizers are available in either cast iron tube construction (Type 25) or steel tube construction (Type 12).

Pressure parts are rugged and joint flanges independent of support flanges.

Green Fuel Economizer's reputation of 60 years assures you of satisfactory performance and quality. Send for Bulletin No. 169.



THE GREEN Fuel Economizer COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

More FREE BULLETINS

Begins on page 179

Penfield Mfg Co, Inc, att Mr E H Clohessy, 19 High School Ave, Meriden, Conn.

B64 **ION EXCHANGER** — Alkalinity-reducing unit for boiler plants, controls hardness, total alkalinity and CO_2 in the steam. 2-page leaflet 28X7808 has photo, description. Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.

B65 **DEAERATOR**—Heats and deaerates water in three stages. 4-page bulletin 3677 pictures and describes unit, gives advantages of internal direct contact vent condenser. Permutit Co, Advertising Dept, 330 W 42nd St, New York 36, N.Y.

B66 **VACUUM DEAERATOR** — Removes oxygen and free carbon dioxide from water, protects piping, tanks from corrosion. 8-page bulletin 3698 gives photos, uses. Permutit Co, Advertising Dept, 330 W 42nd St, New York 36, N.Y.

B67 **ION EXCHANGER**—*D-I* cell for process industries. 4-page bulletin 4082 gives characteristics, advantages, photo. Dorr Co, Barry Place, Stamford, Conn.

WELDING

B68 **HARD-FACING** — For restoring old parts, increasing life of new. 12-page bulletin explains method of application, gives properties and uses of *Coast* alloys. Coast Metals, Inc, 1232 Camden Ave, SW, Canton 6, Ohio.

B69 **TOOL AND DIE SALVAGE**—Manual on welding procedure gives case histories on parts repair: tools that can be successfully welded and salvaged, methods of production welding, data on *Eutectic* low temperature welding alloys. 64 pages, illustrated. Eutectic Welding Alloys Corp, 172nd St and Northern Blvd, Flushing 58, N.Y.

B70 **WELDING PRODUCTS**—Engine-driven welder with ac power take-off. 8-page bulletin B-5455 describes 200 amp unit with up to 3 kw standby power, especially adapted to field welding and maintenance operations. Photos, specifications. Westinghouse Electric Corp, Pittsburgh 30, Pa.

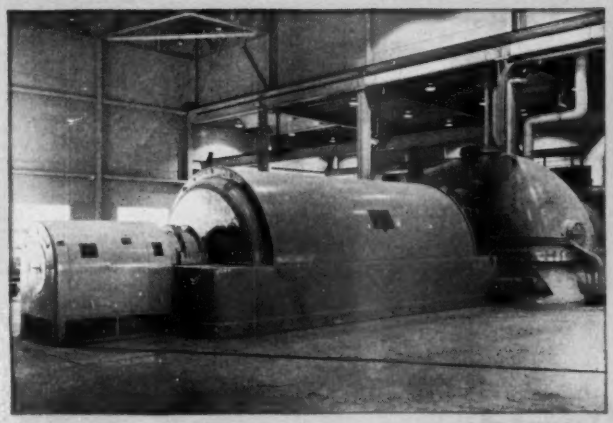
B71 **BRONZE WELDING**—8-page reprint "Jobs You Can Do With Bronze Electrodes" by F E Garriott describes welding techniques and choice of bronze electrodes for welding water heaters, turbine runners, cast iron, etc. Ampco Metal, Inc, 1745 S 38th St, Milwaukee, Wis.

B72 **ALUMINUM BRONZE WELDING** —12-page reprint of a talk "Welding Iron-Bearing Alpha Aluminum Bronze" by F E Garriott discusses weldability characteristics, also carbon-arc, inert-gas metal-arc, inert-gas consumable electrode and submerged arc welding processes. Photos, charts. Ampco Metal, Inc, 1745 S 38th St, Milwaukee 46, Wis.

B73 **GAS CUTTING MACHINE**—Portable No. 20 *Radiagraph* unit. Track-guided. Cuts straight lines, circles, arcs, bevels. 8-page bulletin gives specifications, photos, uses. Air Reduction Sales Co, 60 E 42nd St, New York 17, N.Y.

Dr Gerold Schwarzenbach, noted Swiss scientist, has been granted U. S. patents Nos. 2583890 and 2583891, covering new water-hardness tests. **Hagan Corp,** combustion and chemical engineering firm, and its affiliated companies, are licensed under these patents. Their affiliate, Hall Laboratories, Inc, engineering consultants on industrial water problems, has worked out modified procedures, reagents and equipment that make the basic Schwarzenbach methods convenient for field use.

"Major power companies now specify inhibited turbine oils"



. . . and here's why so many of them choose SHELL TURBO OIL

Shell Turbo Oil exceeds every accepted specification for premium turbine lubricants. These are the notable qualities:

1. HIGHEST ATTAINABLE RUST PROTECTION

An effective *combination* of rust inhibiting additives goes to work at the source of rust formation. Rust problems are reduced to the very lowest level.

2. COMPLETE OXIDATION STABILITY

The anti-oxidant in Shell Turbo Oil has so far defied improvement! It provides outstanding oxidation stability and thereby minimizes sludge formation.

3. ANTI-FOAMING

The anti-foam agent used is so effective that air entrainment can be tolerated for considerable periods—avoiding unscheduled shutdowns.

4. EXCELLENT EMULSION CHARACTERISTICS

Shell Turbo Oil's remarkable protection against rust and oxidation is attained with the minimum tendency to formation of water emulsions in service.

5. PROTECTION AGAINST WEAR

The inhibitive agents in Shell Turbo Oil *add* to the wear-reducing qualities of the specially refined oil itself, an extra margin of safety for the bearings during critical starting periods.

We'll be glad to give you the full story on Shell Turbo Oil, with specific recommendations for your own generating units.

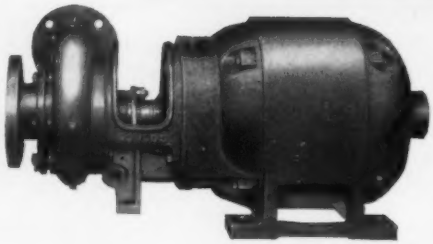
SHELL OIL COMPANY

50 West 50th Street,
New York 20, New York,
or 100 Bush Street,
San Francisco 6, California.

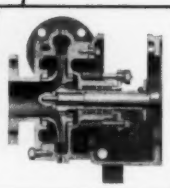
SHELL

SHELL TURBO OIL

Where Space is a Problem...



GOULDS Fig. 3650
Full open top construction permits ready access to gland and stuffing box—particularly desirable when pump is not in a readily accessible position.



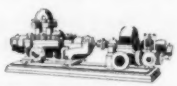
Goulds "Close-Cupld" Centrifugal Pump is the Answer

This versatile pump, simple and sturdy in design, is an entirely self-contained unit. Its close-coupled design eliminates coupling and assures perfect alignment with freedom from vibration.

The "Close-Cupld" needs no space-consuming special foundation . . . no unwieldy base plate to support pump and motor. As a result, installation costs are low.

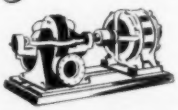
Hundreds of these pumps are doing a wide variety of jobs in factories, steel mills and chemical plants. Interchangeable parts keep inventories low. Available in a wide variety of sizes. Capacities to 2000 G.P.M. Heads to 400 ft. Bulletin 710.1 gives complete specifications. Send for it today. Or call your Goulds representative for the full story.

Other GOULDS Widely Used Throughout Industry



GOULDS Fig. 3360—High pressure multistage centrifugal. Full range of capacities and pressures. Bulletin 722.5.

GOULDS Fig. 3047
Nonclogging impeller of this vertical sump pump will handle water containing solids or fibrous materials.



GOULDS Fig. 3450—Double-suction, single-stage Goulds centrifugals. Up to 15,000 G.P.M. Heads up to 500 ft. Bulletin 721.2.

MEMBER

Goulds PUMPS INC. Seneca Falls New York

APPOINTMENTS

New Corporation Executives

R S Stevenson is elected executive vice-president of **Allis-Chalmers Mfg Co**; Willis G Scholl succeeds him as vice-president in charge of the tractor div. At **Rust Engineering Co,** R L Hess Jr is elected a vice-president.

Robert W White becomes a director of **American Locomotive Co.** George McCuskey joins **Youngstown Sheet and Tube Co** as assistant to the president. At **Worthington Corp,** H J Meeker has retired from his post of assistant to vice president T Cruthers.

Philco Corp appoints Raymond A Rich vice president of the refrigeration division, and Harold W Schaefer vice president, engineering, of the same division.

Kenneth C Lasseter is promoted to vice-president in charge of operations at **Savannah Electric & Power Co.** Frank L Magee becomes a director of **Aluminum Co of America**; Alfred M Hunt takes over as secretary of Alcoa, succeeding J R D Huston who has retired.

Fischer & Associates appoint Wm A Dorff executive vice-president, and Henry M Reese sales director. At **Catalytic Construction Co,** Gerald J Smith is elected to the board of directors.

New Operations Executives

Carl A Salmonsen becomes acting manager of **General Electric Co's** control dept, replacing Karl R VanTassel who was recently appointed general manager of the Knolls Atomic Power Laboratory, operating dept. Robert A Burns Jr is new manager of employee relations for the turbine dept at Lynn, Mass.

Paul Diserens is retiring as director of research and development of **Worthington Corp,** but will continue as a technical consultant. He had been with the company 43 years, was responsible for development of the Worthington feather-valve and variable capacity control for compressors. He is a fellow of the ASME. Ralph M Watson succeeds him as director of research. M E Zeigenhagen becomes advertising and sales promotion manager.

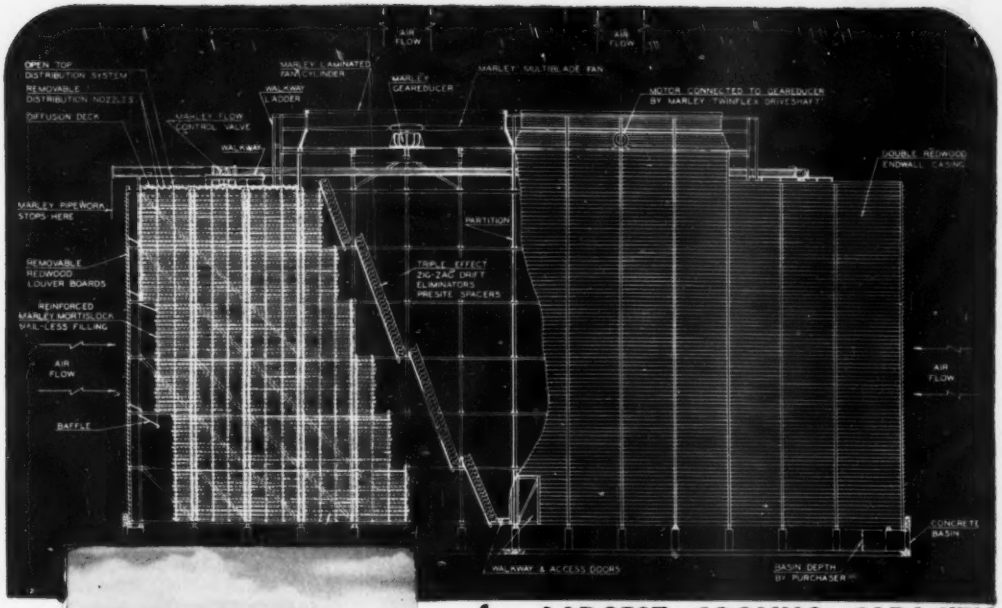
Dr George L Weil resigns as assistant director of the reactor development div of the **Atomic Energy Commission.** He will become a private consultant in nuclear reactor design and engineering.

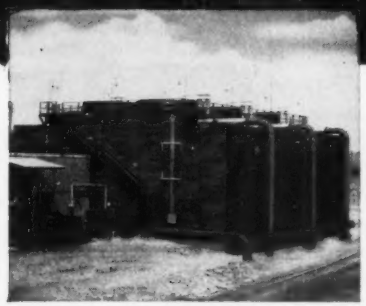
At **Westinghouse Electric Corp,** J M Allen becomes manager and Ricardo Muniz superintendent of manufacturing at the television-radio div in Sunbury, Pa.

Joseph A Messenger, vice-president, general manager and director of **Buell Engineering Co, Inc,** is retiring to take up consulting engineering activities in Philadelphia. **Blaw-Knox Co** combines its power piping and sprinkler divisions, and names Duncan A Black manager of the new division.

Edward A Hassan Jr becomes manager of the raw materials dept of **Kaiser Aluminum & Chemical Corp,** succeeding the late M B Lovelace.

Lester A Shea, on leave of absence from **Lindberg Engineering Co,** becomes chief of the industrial heating equipment section, metalworking equipment division of the





for LARGEST COOLING CAPACITY with LIMITED TOWER AREA

Engineers who know, choose MARLEY Twin-Flow

Twin-Flow cooling towers concentrate maximum cooling ability in every square foot of plant area . . . make fullest utilization of the many exclusive advantages of Marley cross-flow cooling. That's why they deliver largest quantities of cold water at economical cost per gallon.

High, louvered sides provide even air flow throughout all parts of the patented Marley filling that breaks up the water most completely and at closest intervals. This long, thorough air-water contact means performance —the ability to cool more water to lower temperatures.

Twin-Flow design includes Marley open distribution for at-a-glance inspection, simplified maintenance and safety for operators. All mechanical equipment is Marley designed and manufactured exclusively for cooling tower service and is field-proved in thousands of installations. Marley structural strength that means long service life is a fundamental of Twin-Flow engineering.

Marley Application Engineers in fifty cities will gladly show how Twin-Flow cooling towers can bring added economy to your plant.

producers of

DOUBLE-FLOW TOWERS
AQUATOWERS
DOUBLE-FLOW AQUATOWERS
DRICOOLERS
NATURAL DRAFT TOWERS
CONVENTIONAL TOWERS
SPRAY NOZZLES

MARLEY

The Marley Company, Inc.

KANSAS CITY 5, MISSOURI

Your Management wants to know...

How to solve the dust abatement problem... economically

PLANT ENGINEERS, working with Buell engineers, have proven again and again that their know-how coupled with Buell's long experience in Dust Collection can solve your Fly Ash problems more economically, more efficiently.

What's more, Buell Dust Collection Systems offer all American industry these further advantages: smoother plant-community relations, improved product quality and higher employee morale.

Buell's knowledge and experience in the highly specialized science of Dust Collection are yours. To learn more about Buell's **3 basic systems** of Dust Collection and how they can help you, send for the new, informative booklet titled, "The Collection and Recovery of Industrial Dusts." Buell Engineering Company, Dept. 50-1, 70 Pine Street, New York 5, New York.

Van Tongeren Cyclone | 'SF' Electric Precipitator | Precipitator-Cyclone Combination | Type 'LR' Collector | Dust Hopper Valves

buell

ELECTRIC CYCLONIC

ENGINEERED EFFICIENCY IN DUST COLLECTION

More APPOINTMENTS

Begins on page 242

National Production Authority (NPA).

Gamewell Co appoints Frank P Joyce works manager. Karl Muller becomes assistant plant superintendent at Ninemile Point station of **Louisiana Power & Light Co.** W R Riggs becomes manager in charge of general services, R H Gardner and R D Pinkerton become new research associates at **Sinclair Research Laboratories, Inc.**

Foxboro Co increases its training school staff by appointing W H T Furry as an associate director. Technical director on the general manager's staff of **General Motors Research Laboratories** is John M Campbell. Dr Lloyd L Withrow succeeds him as head of organic chemistry dept.

George H Tuttle is appointed director of the **Detroit Edison Co** public information division. E C Medcalf takes over as head of the coal tar chemicals department, **American Cyanamid Co,** succeeding the late Q T Dickinson.

Joseph O Young is named general operations manager, Harry E Eyler, general sales manager, and Rufus B Jones industry service director of **Trailmobile, Inc.** Stanley C Johnson is appointed chief abrasive inspector for **Norton Co,** replacing Harry O Anderson who retired July 1 after 51 years with the company.

Engineering Personnel

Link-Belt Co appoints Robert W Suman chief engineer for the new Colmar, Pa., plant; Norman Virkler succeeds him as chief engineer of the Philadelphia plant. Ambrose C Miller comes to **Wm Brand & Co** as product engineer.

Wm K Sonnemann becomes manager of the relay engineering section, meter division, **Westinghouse Electric Corp.** Maurice A Thorne is new engineer in charge of the vehicle development group at **General Motors Corp.** R V Hutchinson and G C R Kuiper will assist him.

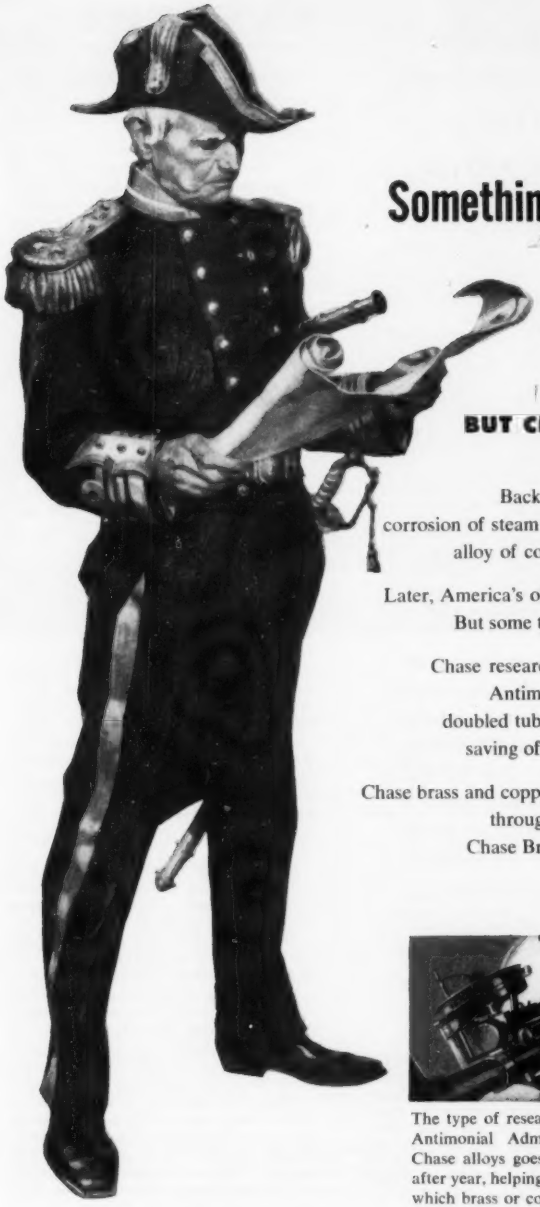
Bureau of Reclamation, Region II, Sacramento, Calif., appoints Ivan P Head assistant regional planning engineer. Ivan L Bateman becomes assistant chief electrical engineer for the **Los Angeles City** dept of water and power.

Ned H Snyder, supervising engineer of the fuel inspection section of the **Bureau of Mines,** U. S. Dept of the Interior, retired June 30 after more than 45 years of outstanding government service.

Sales Personnel

Minneapolis-Honeywell Regulator Co appoints seven regional industrial sales managers: Jack E MacConville, Southeast, Atlanta; Alfred J McCullough, Central, Cleveland; Howard L Marston, Northwest, Minneapolis; Robert L Mallory, Southwest, Dallas; Robert B Grant, Pacific and Mountain, Los Angeles; Lester W Williams, Pacific Northwest, Portland. New industry sales managers are George Gilliam, engines and test facilities; and C J Smolinske, pyrometer supplies.

New England manager of **Jenkins Bros** is Herbert H Jaynes, succeeding Anthony D Weber who is retiring. **J E Lonergan Co** has set up eastern and western sales



Something the Admiral didn't know

BUT CHASE RESEARCH LATER DISCOVERED

Back in 1870, British ships were often put out of action by corrosion of steam condenser tubes. To make these tubes last longer, an alloy of copper, zinc and tin called "admiralty" was developed.

Later, America's oil industry used "admiralty" tubes in heat exchangers. But some types of water caused zinc to separate from the copper.

Chase research metallurgists then developed a new alloy — Chase Antimonial Admiralty* which in many instances more than doubled tube life. Alloys of this type have resulted in an estimated saving of $3½ million a year for the petroleum industry alone.

Chase brass and copper alloys are available, subject to government controls, through jobbers and Chase's 23 convenient mill warehouses. Chase Brass & Copper Co., Incorporated, Waterbury 20, Conn.

U. S. Pat. No. 2,061,921

The type of research that developed Antimonial Admiralty* and other Chase alloys goes on at Chase year after year, helping industry determine which brass or copper alloy is suited to each industrial need.

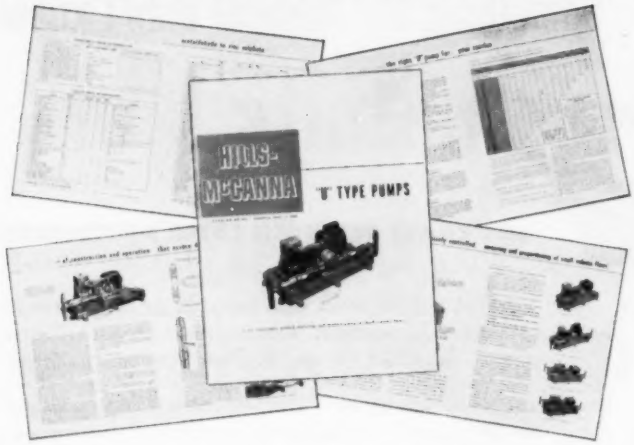
Telnic® Bronze, another Chase development, makes better aircraft instrument parts, radar tubes and other electronic equipment. It was "tailor-made" for industry by Chase research metallurgists.

Chase *The Nation's Headquarters for* **BRASS & COPPER**

Chase Brass & Copper Co. is a subsidiary of KENNECOTT COPPER CORPORATION

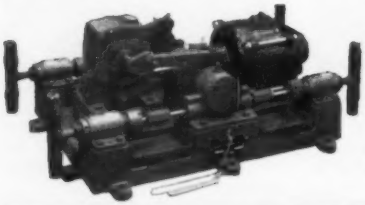
CHASE BRASS & COPPER CO., WATERBURY 20, CONN., Warehouses and Sales Offices at:— Albany† Atlanta Baltimore Boston Chicago Cincinnati Cleveland Dallas Denver† Detroit Houston† Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester† St. Louis San Francisco Seattle Waterbury (†sales office only)

Here's a handy guide to the selection of metering and proportioning pumps



In this new catalog and pump selection manual for Hills-McCanna "U" Type Metering and Proportioning Pumps is all the information, including prices, for the selection of exactly the right pump for handling over 300 substances. Clearly and concisely, this helpful booklet gives all the necessary information and specific recommendations to cover the vast majority of needs that can be filled with a Hills-McCanna "U" Type Pump.

If your operations involve the metering or proportioning of small volume flows, you will find this catalog a useful addition to your files. We will be pleased to send you a copy on request. HILLS-McCANNA COMPANY, 2369 W. Nelson St., Chicago 18, Illinois.



Hills-McCanna "U" Type Pumps are reciprocating, variable stroke, mechanical drive units with maximum capacities ranging from 0.10 to 24 gph. per feed. One, two, three and four feed assemblies are available. Operating pressures up to 5,000 psi. A four feed unit is shown at the left.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of: Saunders Patent Diaphragm Valves Force Feed Lubricators • Magnesium Alloy Sand Castings

More APPOINTMENTS

Begins on page 242

divisions, defined by a line from Detroit to New Orleans. Eastern division sales manager is A F Stumm; western division manager is W F Braun.

C Spence Purnell becomes eastern district manager of the electric utility dept, **Westinghouse Electric Corp**; George C Brown is assistant manager. **Worthington Corp** names Paul J Foley manager of its Kansas City office, and Wm M Fine manager of its Milwaukee office.

Standard Pressed Steel Co appoints F J Kinsella to the newly-created post of midwest regional sales manager. Daniel F Hulgrave Jr succeeds him as manager of the Detroit territory. New SPS sales representatives are Marshel Moorhouse, New York City, Walter H Cunnington, St. Louis, and James C Humphries, Los Angeles.

E J Bauer is new manager of power transformer apparatus sales for **General Electric Co.** George Norman becomes sales manager of **Corning Glass Works'** new products division. At **Blaw-Knox Co,** R A Troman is appointed assistant sales manager of the tower department.

J E Rhoads & Sons appoints three new sales engineers: Charles B Blanchard, working out of Syracuse, N. Y., Donald C McClure and Warren A Johnson, operating out of Chicago. Maurice R Eastin is new assistant manager of the control sales division, **Perfex Corp**; Malbourne Clarke will head sales in eastern and northern Ontario, for Perfex Controls Ltd. E L Mitchell is new southwestern district manager for **Davey Compressor Co.**

C Merle Call resumes his duties as New York sales engineer for Kaylo division of **Owens-Illinois Glass Co,** after service with the Marine Corps. G O Hartzell joins **Libbey-Owens-Ford Glass Co** fiber glass division for general sales duties in the central region.

Robert C Carruthers is assistant sales manager, welding products, for American Manganese Steel Division, **American Brake Shoe Co.** Roger W Clements becomes general office representative, stationary and marine renewal parts sales, for **American Locomotive Co.**

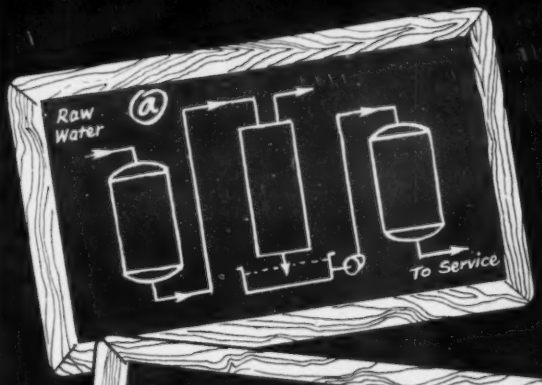
W J Resiner takes over as manager of stainless steel tubing sales, steel and tubes division, **Republic Steel Corp.** David W Martin is appointed district sales manager in charge of the Atlanta office of **Youngstown Sheet and Tube Co.**

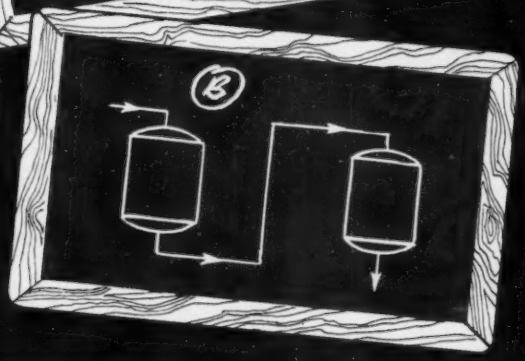
Norton Co appoints Robert Cushman Pacific Coast district manager with headquarters in Los Angeles. Donald F Jones is abrasive engineer in central New York; Kenneth F Ebbeson becomes field engineer in the northeastern district; new abrasive engineers are Harry G Brustlin, Pacific Coast district, and Gordon S Brandes, Rocky Mountain area. H Paul Otto becomes district manager of the Hartford, Conn., area, replacing Carl W Atwood who is retiring; John D Putnam becomes Worcester machine sales supervisor; Allen C Moore is field engineer and Thomas M. Thornton district sales engineer in Detroit.

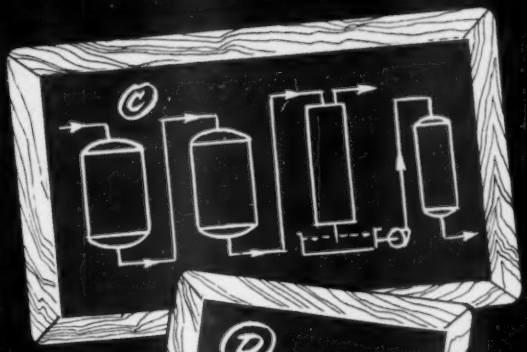
New Sales Offices

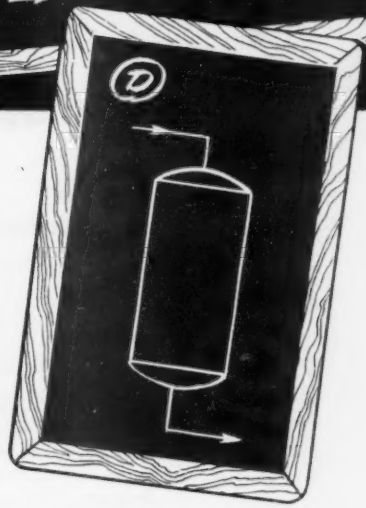
David W Jones Jr, sales representative

The ABC's of Better Boiler Feedwater









● Permutit ion exchange processes remove dissolved mineral matter including silica. And produce feedwater equivalent to distilled water at only a small fraction of the cost of distillation.

For high pressure power plants that means it is now possible to avoid boiler scale and hard-to-remove silica deposits on turbine blades.

Demineralization is accomplished by the use of two ion exchange resins—Permutit Q and Permutit S. Permutit Q is a high capacity hydrogen cation exchange resin. Permutit S is a highly basic anion exchange resin.

Several arrangements of equipment are used depending on the individual requirements—composition of the raw water, volumes to be treated, boiler pressures and operating conditions. Permutit will cooperate with you in selecting the hookup best suited for your boiler plant. Write today for full information.

A **TWO STEP WITH DEGASIFIER:** In large demineralizing plants, a degasifier is usually included as an inexpensive means for removing carbon dioxide.

B **TWO STEP WITHOUT DEGASIFIER:** No repumping required. Used where total quantities are not very great or with waters of low bicarbonate content.

C **THREE STEP WITH DEGASIFIER:** Extremely economical and effective arrangement for waters containing relatively high amounts of sulfates and chlorides.

D **MIXED BED:** An extremely compact arrangement. Both cation and anion exchangers are in the same unit. Used alone or as a final step.

The equipment described is also furnished in multiunit arrangements to treat whatever quantities of water are required and to meet all operating conditions.

PERMUTIT®

ION EXCHANGE AND WATER CONDITIONING HEADQUARTERS

for 30 years...

the nameplate of efficiency

PEABODY BURNERS FOR INDUSTRY—

Since 1921 Peabody Burners have served industry throughout the world, and continual research and development have maintained Peabody as the leader wherever reliable, efficient operation is important.

If you have a combustion problem involving commercial liquid, pulverized or gaseous fuels or by-product fuels such as blast furnace gas, refinery sludges and sawdust, look to Peabody for custom-engineered efficient and economical equipment. Combined Burners to fire two or more of these fuels are available.

Write for complete set of Peabody Bulletins. No obligation.

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N.Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers.

OFFICES IN PRINCIPAL CITIES 767

PEABODY LIMITED • LONDON, S.W.1, ENGLAND

More APPOINTMENTS

Begins on page 242

for tubular products division of **Babcock & Wilcox Co,** has opened new offices in Goby Bldg, 1321 Bannock St, Denver, Colo.

George J Greaney Jr has opened up a new office for the **Elliott Co** at 731 Wilson Bldg, Corpus Christi, Tex.

Swartwout Co opens a new district sales and service office for its power plant and autronic control divisions at 317 W Main St, Alhambra, Calif. Roger L Gilliland is manager.

Johnson Service Co opens new branch offices at Rochester, N. Y., under Harvey E Siebert, and Great Falls, Mont., under Hugh M Rowe.

Libbey-Owens-Ford Glass Co opens new district sales office at 1437 Statler Bldg, Boston, Mass., under Hilary H Smart

Quaker Rubber Corp establishes new branch warehouse and sales office at 430 S Mill St, Lockland 15, Cincinnati, Ohio, under W W Hutchinson. New stock-carrying branch warehouse and sales office at 1327 Levee St, Dallas, Tex., is under D C Hahn, district manager.

Distributors

Warren Steam Pump Co, Inc, appoints Process Industries Engineers, Inc as their representatives on industrial sales. Arch T Miller is district manager with headquarters at 12417 Cedar Rd, Cleveland 6, Ohio.

Edward Valves, Inc, appoints Reed & King, Inc, Foshay Tower, Minneapolis 2, Minn., sales representative for Minnesota, North and South Dakota, northwestern Wisconsin.

Conoflow Corp names Bruce Greaves Co its representative in St. Louis.

Sterling Electric Motors, Inc, names the following distributors: Alex Borders Machinery Co, 3724 First Ave North, Birmingham 6, Ala.; Industrial Dairy Supplies, Inc, Buck & Pine Sts, Millville, N. J.; Prussack Electric Co, 1817 Pitkin Ave, Brooklyn 12, N. Y.; Petro-Chemical Equipment Co, Inc, P.O. Box 6705, 2438 S Boulevard, Houston 5, Tex; Elm Electric Supply Co, 49 Elm St, Stamford, Conn.

Nordberg Mfg Co appoints Olson Equipment Co, 2930 Blaisdell Ave, Minneapolis, Minn., distributor for Nordberg 4FS diesel engines.

Cleaver-Brooks Co appoints Mason Equipment Co, 2281 Wildwood Blvd, Toledo, Ohio as manufacturer's representative.

New York Belting & Packing Co's new distributor in Utah and southeastern Idaho is the Rocky Mountain Machinery Co, Salt Lake City.

Childers Mfg Co appoints these new sales representatives: Fred W Koester Co, 743 N 4th St, Milwaukee, Wis.; Jarvis Equipment Co, P.O. Box 33, Station D, Cincinnati, Ohio; W M Acker Organization, Inc, 3167 Fulton Rd, Cleveland, Ohio; Jobe & Co, 344 E 33rd St, Baltimore, Md; Northern Heating and Insulating Reg'd, Arvida, Quebec.

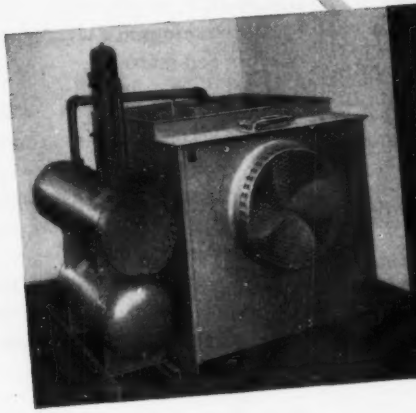
Control Engineering Corp appoints Peacock Brothers Ltd as exclusive distributor in Canada.

Farr Co names four new manufactur-

New

SAVES WATER and CUTS MAINTENANCE COSTS . . .

Illustrations show two views of a 55 ton Condenser Tower prior to partial disassembly for shipment.



Vogt

CONDENSER TOWER

FOR CONDENSING REFRIGERANTS

SINGLE RESPONSIBILITY:

Vogt, leading builder of refrigeration condensers, assumes responsibility for engineering the unit. Only one purchase order needed.

SHOP FITTED:

To cut down field assembly labor. Requires no cutting or fitting of pipe.

Designed for today's water conservation requirements, and to keep refrigeration costs low, the *new* Vogt Condenser Tower meets the need for a proven, readily cleanable condensing unit.

The Vogt Condenser Tower consists of a multipass straight tube condenser, a receiver, an oil trap, a cooling tower, and a water pump. Removable cast iron heads permit easy cleaning of the condenser tubes.

Water costs are extremely low since the cooling water is recirculated continuously and requires only a small amount of makeup to replace losses due to windage and evaporation.

Condenser Tower units are available in capacities ranging from 5 to 50 tons refrigeration. Additional information will be furnished upon request.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

STEAM TURBINES

TYPE UV MULTISTAGE

• Available with from two to ten pressure stages. Horsepower range from 100 to 4000, steam pressures up to 600# ga., 750°F., condensing or non-condensing. Optional governor equipment and accessories adapt UV Turbines to any mechanical drive within their capacity range.

Contact your Murray representative or write for Bulletin T-122.

MURRAY IRON WORKS COMPANY, BURLINGTON, IOWA

MURRAY for over 75 years

Builders of Steam Power Equipment

More APPOINTMENTS

Begins on page 242

er's representatives: Donald Southard, Denver, Colo.; F W Jenike Co, Cincinnati, Ohio; Charlie Wood Co, Columbus, Ohio; Wm M Shank Co, Indianapolis, Ind.

Owens-Illinois Glass Co names these distributor-applicators for Kaylo heat insulation: Homestead Insulation Co, 45 Granby St, Hartford, Conn.; Gram Asbestos Co, Erie, Pa.; Allied Services, Inc, Charleston, W. Va.

New Companies, Consolidations, Addresses

Allison L Bayles establishes consulting engineering office for product investigation and development, plant layout and fine particle techniques, at 713 St. James St, Pittsburgh 32, Pa.

Kewanee Boiler Corp and Ross Heater & Mfg Co, Inc, divisions of American Radiator and Standard Sanitary Corp, have combined to form a new company, **Kewanee-Ross Corp.** Both units will continue to operate as before.

Speer Carbon Co and its subsidiaries, Jeffers Electronics, Inc, International Graphite and Electrode Corp, and Speer Resistor Corp have consolidated into one company, the Speer Carbon Co, with headquarters at St. Marys, Pa.

Ric-will Plastic Coating & Mfg Corp will enter the field of protective coatings for industry with their line of *Ricwilite* phenolic resin coatings. Manufacturing plant is in Salem, Ind.

Nooter Corp establishes the **St. Louis Metallizing Co,** to be located at 625 S Sarah St, St. Louis, Mo. Formerly the metallizing division of Nooter, the company will retain the same personnel.

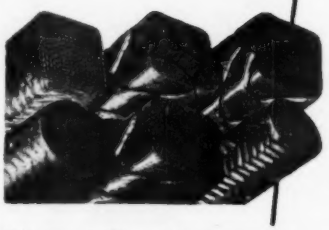
Borg-Warner Corp acquires the Reflectal Corp, with executive offices in New York City and plant at Hudson Falls, N. Y. It will be operated as a subsidiary.

Manufacturing and operating facilities of the former Wheelco Instruments Co have been transferred to Rockford, Ill. Correspondence should be addressed to **Wheelco Instruments Div, Barber-Colman Co,** Rockford, Ill.

New $4.5 million Kyrene steam plant in the **Salt River Valley Power District** in central Arizona has 30,000 kw rated capacity. It is the only outdoor central station steam plant in Arizona. Boiler produces 350,000 lbs of steam per hr, is fired with natural gas. There is provision for burning part oil and part gas or all oil in emergencies. The General Electric turbine-generator produces 12,500-v, three phase, 60-cycle energy; has top capacity of 37,500 kw.

Texas Eastern Production Corp is preparing to drill an offshore well on their lease 20 miles southwest of Galveston and 7½ miles off the coast of Galveston Island in the Gulf of Mexico. The well, projected to 6000 ft vertical depth, will be drilled as a directional hole to the southeast to help define the location and extent of natural gas reserves under the company's 11,070-acre offshore block.

BELMONT



No one *deliberately* compromises with quality in vital braided packings. You're probably *paying* for the best, so why not make certain you're getting it—specify BELMONT, headquarters for braided packings in a wide range of types and materials.

Belmont braided packings are described and picturized in catalog No. 40. The type of braid is dependent upon the service conditions, and the materials used are asbestos, flax, cotton, jute, ramie, teflon and metals, lubricated for the purposes intended. Write on your company letterhead for details today.

Fast, *direct* help on technical problems . . . SERVICE through leading national distributors.

4-M-2A

for Steam • Water • Oil • Gas • Air
Acids • Alkalies • Ammonia

THE BELMONT PACKING AND RUBBER CO.
Butler and Sepviva Streets
Philadelphia 37, Pennsylvania

Rings • Spirals • Coils • Reels
Spools • Sheets • Gaskets
There's a Belmont Packing for every service

Million Pound Boiler at Sunbury Station of the Pennsylvania Power & Light Company

equipped with

LJUNGSTROM AIR PREHEATER

The latest addition to the Pennsylvania Power & Light Company's new Sunbury Station is a unit that adds 125,000 kilowatts to this utility's power output and increases the Station's capacity to over 400,000 kilowatts. The station was designed by Ebasco Services, Inc. under the utility's supervision, and built by the latter.

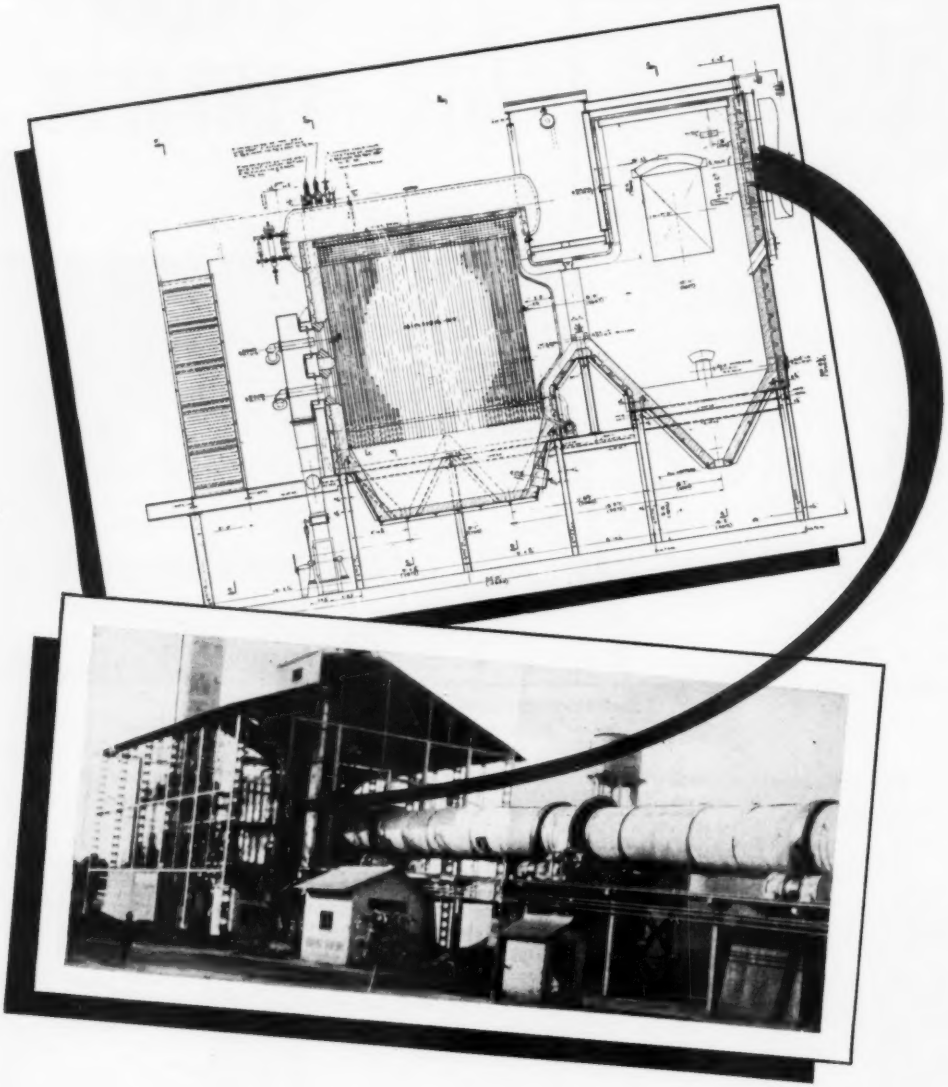
The reheat boiler for this unit was furnished by Foster Wheeler Corporation. It is fired by pulverized coal and has a capacity of 1,000,000 pounds of steam per hour at 1525 psi and 1005 F., reheated to 1005 F.

This Foster Wheeler boiler incorporates a Ljungstrom Air Preheater, which preheats combustion air to 543 F., and cools exit gas to 281 F.

Since the war, the total capacity of steam generating units equipped with Ljungstrom Air Preheaters – installed, under construction or on order in industrial and utility plants throughout the country – comes to well over 285,000,000 pounds of steam per hour. Every boiler manufacturer has included Ljungstrom Air Preheaters in prominent installations made during this period.

THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

A KVS WASTE HEAT OUT OF FUEL



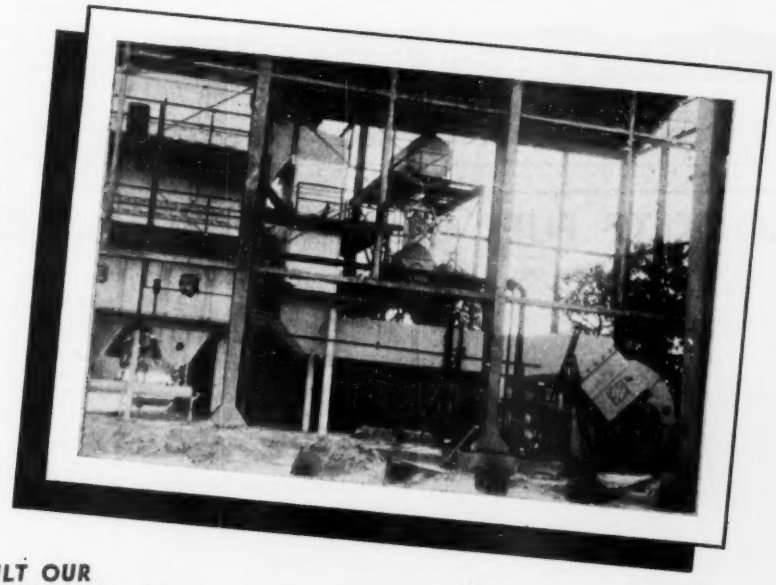
BOILER *Pays For Itself*

COST SAVINGS!

Here's an investment that pays off immediately! Recover usable heat, ordinarily wasted up the stack, with a KVS waste heat boiler installation.

Turn this waste heat into steam for FREE power or process. Use it in the manufacture of cement, lime, dolomite, etc. Reduce your operating costs . . . increase your power production.

These highly efficient KVS waste heat boilers can be readily installed in any plant, old or new. The money they save will quickly pay the cost of installation . . . and continue to earn big dividends year after year.



This photograph shows waste heat boiler, economizer, breaching, I.D. fan, feed water tank and deaerating feed water heater.

CONSULT OUR ENGINEERING DEPARTMENT

IT COSTS LESS.. TO OWN THE BEST!

KENNEDY-VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

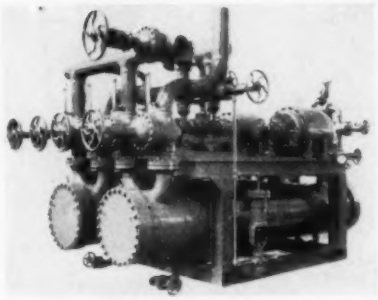
TWO PARK AVENUE, NEW YORK

FACTORY DANVILLE, PA.

TUBES FOR BENT AND STRAIGHT TUBE BOILERS
COIL AND SPECIALTY BENDING
IDEAL FLUE TOOLS
STEEL AND COPPER FERRULES

BOILER TUBE CO. OF AMERICA
McKEES ROCKS, PA.
(Pittsburgh District)
PITTSBURGH CHICAGO
FRED S. RENAULD & CO., LOS ANGELES

LOCKETT FUEL OIL PUMPING AND HEATING SETS



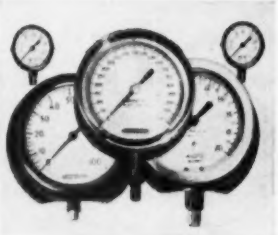
Custom Built

The compact, high-pressure Unit illustrated here was built for a large Utility Station in the South West. It consists of two Motor-driven Pumps and two Shell-and-tube-type Oil Heaters mounted on a single frame. Each pump is designed to handle a capacity of 55,000 pounds per hour of bunker fuel oil, against 300 P.S.I.

For almost a half century, Lockett has been supplying, to fit individual needs, efficient standard and custom-built, Fuel Oil Pumping and Heating Sets, for mechanical and steam atomizing oil burners. Combinations of various types of pumps are available: Either two Turbine-driven Pumps; one Electric-driven and one Turbine-driven Rotary Pump; two Electric-driven Rotary Pumps; two Worthington Duplex Steam Pumps; or one Duplex Steam Pump and one Electric-driven Pump. Each pump-and-heater is suitable for the full rated capacity of the unit; the second pump and heater are spares. Lockett supplies everything, complete. Inquiries are invited. *Descriptive bulletins sent on request.*

A. M. LOCKETT & COMPANY, LTD.
Contracting Mechanical Engineers
NEW ORLEANS - HOUSTON - DALLAS - GALVESTON

Lonergan



GAUGES

—28 TYPES—
—OVER 100 MODELS—
—16 CASE STYLES—

Lonergan Pressure Gauges are preferred widely in power and process industries for their accuracy, dependability, exact engineering and modern design. They are made in sizes from 2½ to 12 inches and utilize Bourdon tube, diaphragm or bellows power elements in conjunction with modern precision movements.

OUR REPRESENTATIVES ARE READY TO SERVE YOU

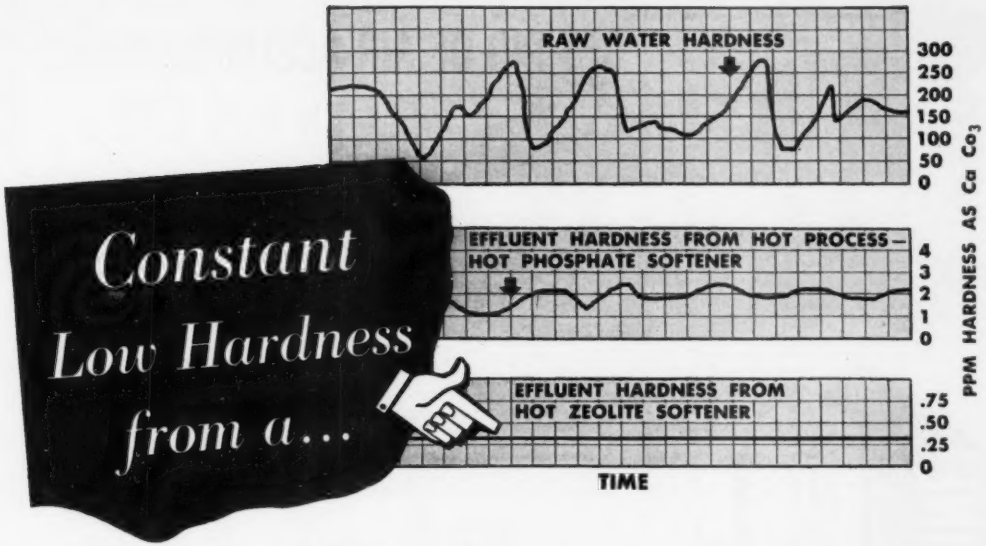
Lonergan representatives in all industrial centers are ready to advise you competently on your gauge needs. *Call on them or write us for catalog 800-G.*

There's a LONERGAN SAFETY-RELIEF VALVE for every purpose

A large variety of standard types for all needs. Nearby distributors can supply you.

Lonergan

J. E. LONERGAN COMPANY
Race and Second Sts., Phila. 6, Pa.
1952 — Our 80th Year



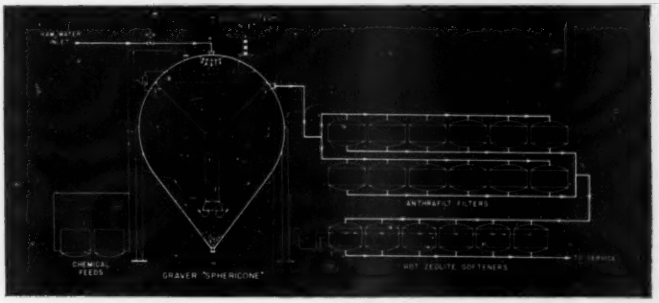
...Graver Hot Process Hot Zeolite Softener

Conventional lime-soda-phosphate hot process softeners effectively reduce raw water hardness. However, with extremely variable raw water supplies, chemical feeds must be adjusted to furnish precise quantities of chemicals in relation to raw water hardness and alkalinity in order to obtain suitable low hardness at all times.

The recent development of high-temperature resistant zeolites has provided a convenient solution to this problem. Substituting a second-stage hot-zeolite treatment, with Gravex styrene-base resin zeolite, instead of the more costly phosphate after-treatment, *constantly* low-hardness water is obtained *regardless* of sudden fluctuations in the initial hardness of the raw water . . . and at *lower cost.*

Therefore, if your raw water varies in source or hardness, be sure to investigate the Graver Hot Process — Hot Zeolite Softener. Graver engineers are available to discuss this process with you and compare its advantages over other processes at no obligation to you whatsoever.

Write for reprint of informative article on the features and benefits of hot zeolite softening.



GRAVER

GRAVER WATER CONDITIONING CO.

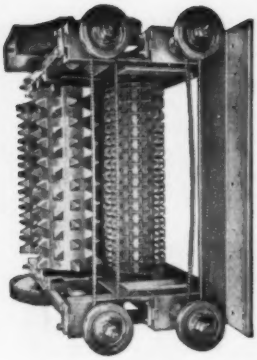
Division of Graver Tank & Mfg. Co., Inc.

DEPT. P-HP, 216 WEST 14th STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd.; Cobourg, Ontario

In Mexico: Proveedores Tecnicos, S.A.; Pueblo 259, Mexico 7, D. F.

GW-427



Crusher is pictured without hopper and sprocket guards, but is delivered complete.

TWO STAGE — DOUBLE ADJUSTMENT

WRITE TODAY FOR CRUSHER BULLETIN P-3

Two Stage CRUSHING IN ONE MACHINE!

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot

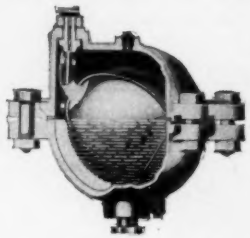
The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

T. J. GUNDLACH Machine Co., Belleville, Ill.

GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



a BIG Trouble Saver that Costs You LITTLE!

When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

The Simplex Air Valve is easily installed . . . positive in action . . . ample in capacity. Standard valves for pressures up to 250 p.s.i. . . . special valves for pressures up to 800 p.s.i. Thousands have been in successful use for over 30 years.

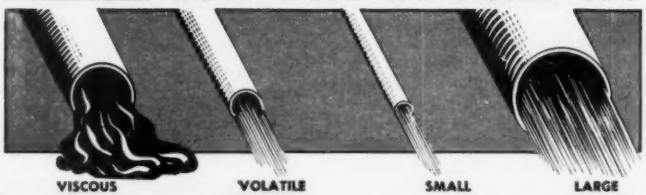
IT'S SIMPLEX IT'S ACCURATE

Write for free bulletin to Simplex Valve & Meter Co., Dept. 5, 6780 Upland Street, Philadelphia 42, Pa.

SIMPLEX

VALVE AND METER COMPANY

PROBLEM HOW WILL WE PUMP IT?



VISCOUS LIQUIDS TO 2,500,000 SSU. • VOLATILE LIQUIDS EVEN LP-GAS • SMALL CAPACITY ½ GPM • LARGE CAPACITY 1050 GPM

ANSWER *with* VIKING ROTARY PUMPS

The simple, positive, "gear within a gear" Viking principle has answered these problems for so many, so well, for so long, there is every good reason to know it will do it better for you.

What are your problems? Send them in today and ask for folder 52SW.

VIKING AN HONORED NAME IN PUMPING

VIKING PUMP COMPANY

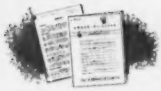
CEDAR FALLS, IOWA

THE ORIGINAL "GEAR-WITHIN-A-GEAR" ROTARY PUMP

HOT LIME–AMBERLITE IR-120...

An Economical Method for Treating Boiler Feedwater

The use of AMBERLITE IR-120 cation exchange resin following the hot lime process eliminates the need for soda ash and sharply reduces phosphate requirements in the treatment of boiler feedwater. Results:

1. **Lower operating costs**—The cost of salt regenerant for AMBERLITE IR-120 is very much lower than the cost of soda ash and phosphate.
2. **High quality feedwater**—High capacity AMBERLITE IR-120 yields water of virtually zero hardness regardless of fluctuations in influent water composition. The resin permits use of excess lime, which results in steam having lower carbon dioxide.
3. **Long trouble-free service**—AMBERLITE IR-120 is stable toward heat, alkali, and acid.
4. **Simplification**—Smaller space is required for AMBERLITE IR-120 exchanger units than for second stage phosphate settling tanks. Only one chemical—lime—is used in the hot process.

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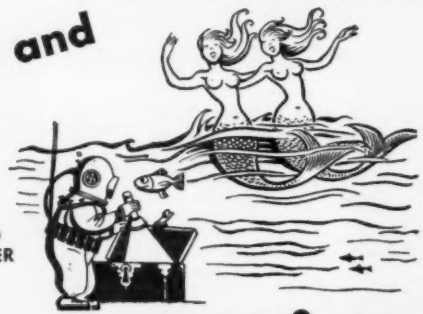

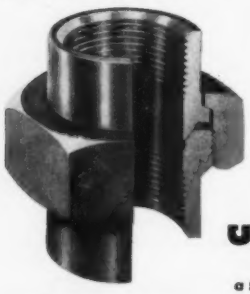

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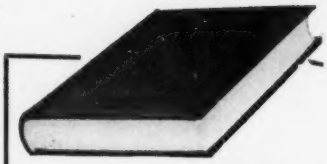

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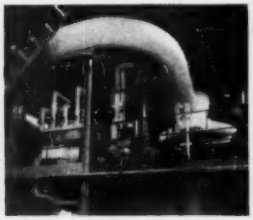

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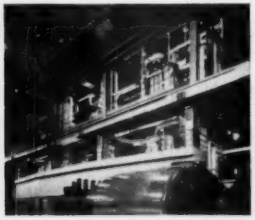

● View of Arapahoe Station from turbine floor. Elevation 5287'. Workmen are applying 8 oz. canvas to lines.

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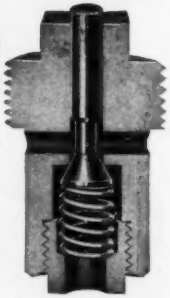

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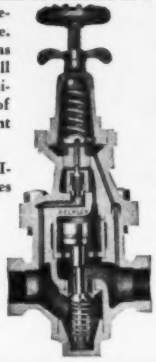

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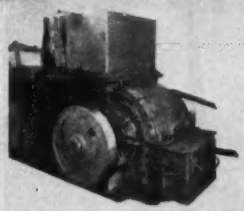

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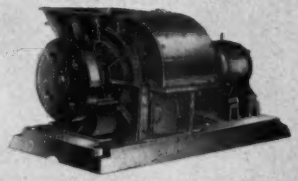

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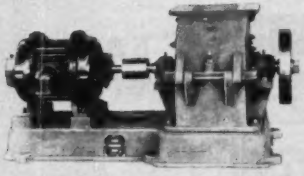

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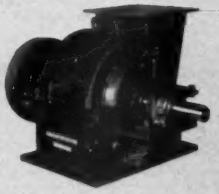

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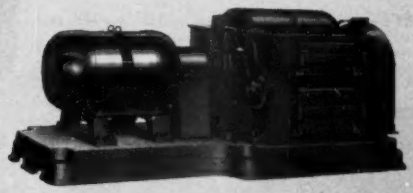

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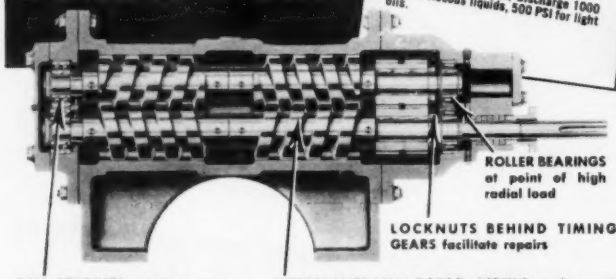

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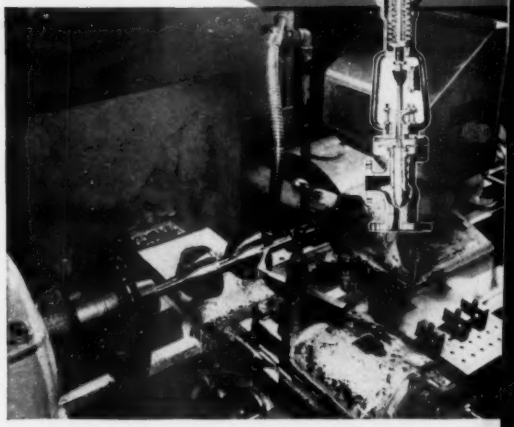

You demand controls designed and engineered by men thoroughly familiar with your industry. You demand the manufacturer be stingy with his tolerances . . . a stickler for exacting accuracy for you know that on such accuracy may depend your cost of operation—the safety of your equipment—the lives, even, of your people.

That's why we know we're being complimented when so many precision minded industries rely so completely on BS&B Climax Controls—they **trust** our knowledge and above all, our **care** in manufacture. BS&B Climax engineers protect this enviable reputation by constantly watchdogging the production of the Climax instrument that safeguards your control of pressures, temperatures, levels and flow.

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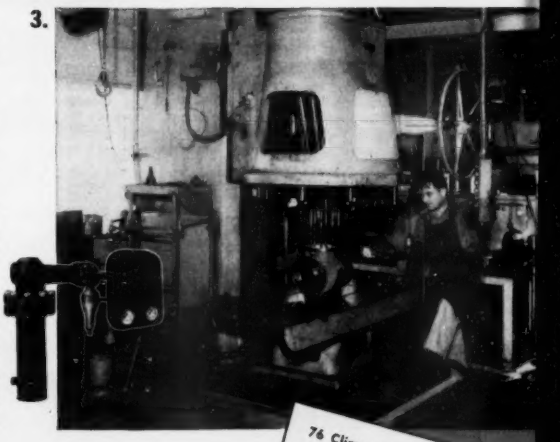
Performance and reliability show up in the manufacturing of Climax Controls. Here are a few of the steps that enable us to turn out over 12,000 different parts used in the assembly of various Climax Controls.

3.



1 **"Peas-in-a-pod" Uniformity.** An electronic-hydraulic duplicator reproduces every inner valve from a template within .001" tolerance, assuring uniform inner valve characteristics.

2 **Part of the modern and orderly Climax Controls** factory . . . milling machines, deburring and grinding bench, drill presses and boring mill. Skilled and experienced operators contribute heavily to your control application where the name Climax appears.

3 **Applying Craftsman's touch to Mass Production.** For economy, which is passed along to you, Climax Controls are produced on an assembly line basis . . . for accuracy, which you enjoy in true performance, a Climax Control is never without the Craftsman's touch. Here a large multiple spindle drill works true bolt circles in a large body. A similar but smaller unit does the same job for smaller parts.

76 Climax Control Centers . . . Ask Your BS&B Man

Call on BS&B for confidential, Climax Engineering Service. Let your BS&B man help you. A Climax control problem? Write for information and specifications on the control you need. For application and construction, write for BS&B Climax Controls catalog.

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JEFFERSON

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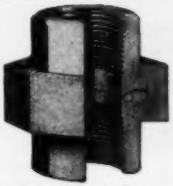

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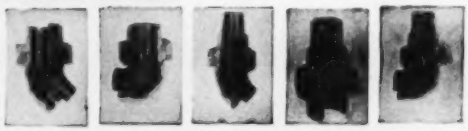
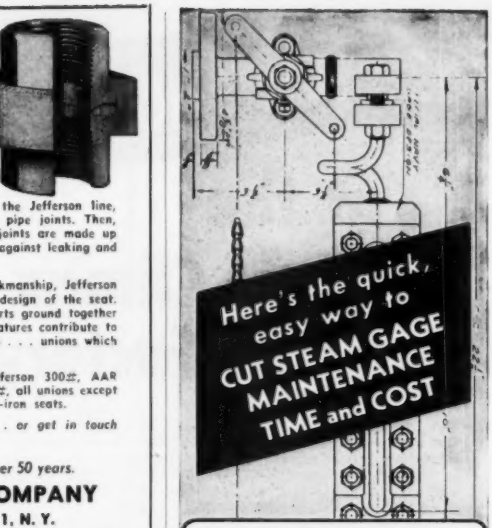
63 Gooding St., Lockport, N. Y. ● 39 Fletcher Ave., Lexington 73, Mass.





Here's the quick, easy way to CUT STEAM GAGE MAINTENANCE TIME and COST

Install Labor-Saving JERGUSON STEAM GAGE UNITS

. . . with gage and valves furnished as integral unit . . . without gage connection stuffing boxes or end stems.

JERGUSON Steam Gage Units, with gage and valves fabricated as a complete working unit will help you eliminate a lot of your maintenance time and troubles.

Especially designed to cut maintenance time, these complete units have no gage connection stuffing boxes to take care of and no end stems to cut or wire draw.

Gages and valves are an integral unit and have special expansion coils to take care of expansion and contraction. Transparent gage may be rotated to any desired angle; chambers and covers are forged steel; glasses are mica protected against erosion. Available in various models for required visible glass and W.S.P.

Cut your maintenance costs now. Write today for copy of drawing GD-515 and Steam Gage Data Unit.

JERGUSON

Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

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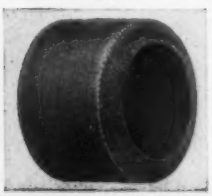
...the Packing that PACKS ALL

We'll solve your packing problem . . . even if it means developing something special

While ALLPAX Packings are available in a wide range of standard styles, we recognize the fact that sometimes a special packing is required to meet certain unusual conditions. Let's hear about your conditions, see what's required and then work out the solution. As packing specialists that's how we like to serve our customers.



Allpax Packings are available for general service against air, water, oils, gases, distillates, etc. for temperatures up to 600°. ALLPAX makes packings also for higher temperatures . . . in coil, ring, or loose form for services involving oils, chemicals, acids, etc. Also Valve Discs, Sheet Packing, Retainer Packing, Molded and Mandrel Cut Packing Rings, Packing Hooks, Gasket Cutters.

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Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

Adjust-O-Feeder
Model X 52

- LOW COST
- COMPACT
  Built-in standard motor — no separate gearbox or couplings.
  Built-in oil-enclosed gear reducer.
- MICRO-STROKE ADJUSTMENT
  Scale easily read —crank and connecting rod operate in horizontal plane.
- LONG LIFE AND EASY MAINTENANCE
  One-piece Meehanite iron frame for positive alignment of all moving parts.
  Double check valves on suction and discharge easily removable.

This new, compact chemical feed pump, by %Proportioneers, Inc.%, is inexpensive and provides accurate boiler water treatment for plants where a low capacity, medium pressure pump will meet requirements. The standard Model X 52 has a capacity range from 1 to 10 GPH and will discharge against pressures up to 650 psig. For lower feeds, the unit is available with a range of from 0.5 to 5 GPH. Complete and self-contained, Model X 52 weighs less than 100 lbs. and is ready to operate as soon as piping and motor are connected.

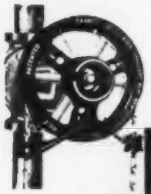
Ask for Bulletin 1105

%PROPORTIONEERS, INC.%

Write to %PROPORTIONEERS, INC.%, 354 Harris Ave., Providence 1, R. I.

Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

Overhead Valves EASILY, QUICKLY AND SAFELY controlled from the FLOOR!



Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

● Range of 10 adjustable sizes takes care of all valve makes and types: fits valve wheel diameters from 2 to 30 inches.

● No more climbing up treacherous step-ladders, on benches, machines or boilers. High-up, inaccessible valves are brought down to earth by the inexpensive BABBITT Adjustable Sprocket Rim with Chain Guide. Here's overhead valve control that is just as positive as direct manual control, and 100% safer—right from the floor!

● The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

● *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

1 Babbitt Square, New Bedford, Mass.

BABBITT STEAM SPECIALTY CO.

EXTRA YEARS

OF MORE DEPENDABLE POWER

and at less cost per pound of steam

TODD BURNERS

GAS OR OIL

COMBUSTION EQUIPMENT DIVISION

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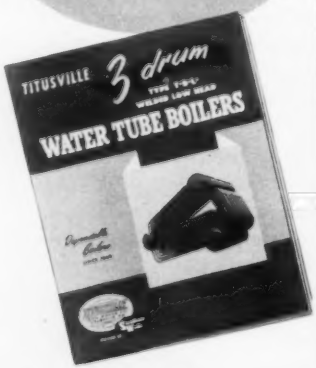
FOR YOUR REFERENCE FILES

...detailed information

ON TITUSVILLE 3-DRUM WATER TUBE BOILERS



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...ASK FOR BULLETIN B-3200A

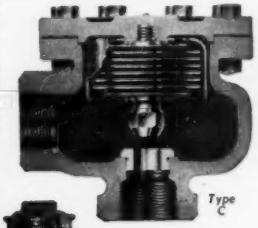
THE TITUSVILLE IRON WORKS CO.
TITUSVILLE, PA. division of
STRUTHERS WELLS CORPORATION

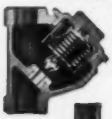
NICHOLSON TRAPS

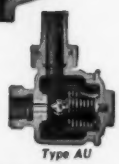
SAVE 4580 LBS. OF STEAM Per CYCLE

A large user of steam on the west coast reports that substitution of Nicholson traps for a mechanical type effected a cyclic saving per dryer of 550 gallons of condensate, or 4580 lbs. of steam. See why leading plants are increasingly adopting Nicholsons for the higher and more even temperatures which result from their advanced features: operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting.

BULLETIN 152







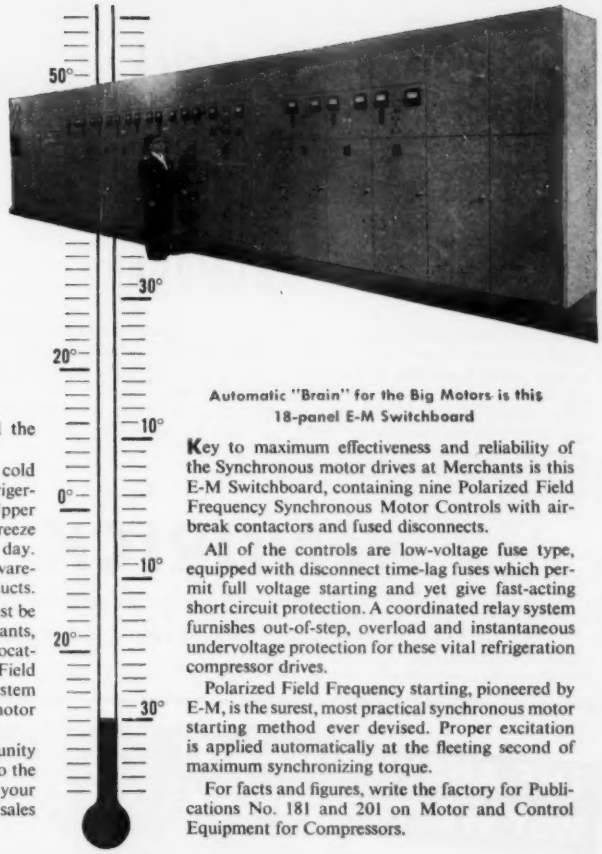
5 TYPES FOR EVERY APPLICATION, process, heat, power. Sizes ¼" to 2"; press. to 250 lbs.

125 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Controlled motor power for 4 acres of cold



Automatic "Brain" for the Big Motors is this 18-panel E-M Switchboard

Four acres in Hopkins, Minnesota are cold the year around.

Reason is the new two-million-cubic-foot cold storage warehouse built by the Merchants Refrigerating Company of New York. Largest in the Upper Midwest, the warehouse is equipped to blast-freeze as much as 100,000 pounds of produce a day. Temperatures in each room of the four-acre warehouse may be varied to suit the individual products.

To maintain such a controlled cold, there must be a steady flow of refrigerating *power*. At Merchants, nine E-M Synchronous Motors drive the reciprocating ammonia compressors. An E-M Polarized Field Frequency Synchronous Motor Control system (described at right), assures correct, precise motor operation.

The E-M Synchronous Motors operate at unity power factor, deliver maximum usable power to the compressors. When power must be tailored to your specific requirements, see your nearest E-M sales engineer for his suggestions.

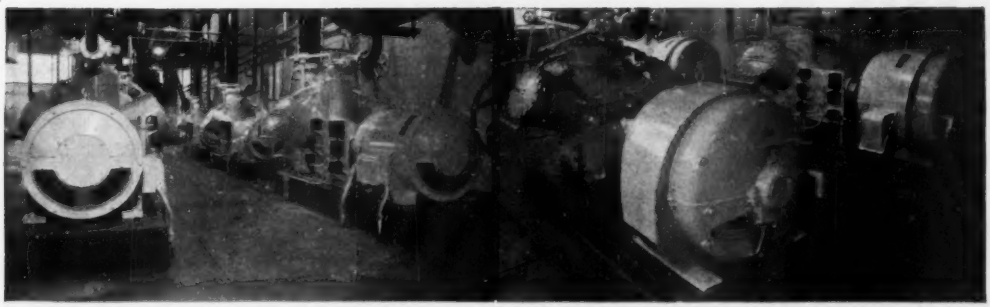
Key to maximum effectiveness and reliability of the Synchronous motor drives at Merchants is this E-M Switchboard, containing nine Polarized Field Frequency Synchronous Motor Controls with air-break contactors and fused disconnects.

All of the controls are low-voltage fuse type, equipped with disconnect time-lag fuses which permit full voltage starting and yet give fast-acting short circuit protection. A coordinated relay system furnishes out-of-step, overload and instantaneous undervoltage protection for these vital refrigeration compressor drives.

Polarized Field Frequency starting, pioneered by E-M, is the surest, most practical synchronous motor starting method ever devised. Proper excitation is applied automatically at the fleeting second of maximum synchronizing torque.

For facts and figures, write the factory for Publications No. 181 and 201 on Motor and Control Equipment for Compressors.

ELECTRIC MACHINERY MFG. COMPANY • Minneapolis 13, Minnesota

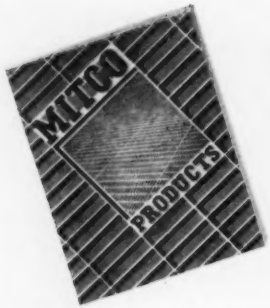


Six 60 hp Synchronous Motors driving low-stage reciprocating ammonia booster compressors. These compressors are used alternately for blast freezing, or brine cooling for storage areas, operating at suction temperatures below minus 30 degrees.

Three 200 hp E-M Synchronous Motors driving high-stage reciprocating ammonia compressors. Temperatures are maintained ranging from 30 below zero in the freezing tunnels to 10 below zero in the more than 1,500,000 cubic feet of freezer storage.

ORIGINATORS OF AUTOMATIC CONTROLS FOR SYNCHRONOUS MOTORS

1100-TPA-2113



Hendrick Mitco Products Catalogue

Tells how Hendrick Mitco is made from steel bars, forced into integral panels under hundreds of tons of hydraulic pressure . . . shows their advantages for open steel flooring, and for stairways, ladders and fire escapes . . . explains their use, with fill of concrete, cement, asphalt or composition, as Armorgrids for floors, platforms, ramps and driveways that have to withstand heavy traffic. Also describes Mitco heavy-duty grating . . . radial grating for circular walkways . . . aluminum grating for use where light weight or corrosion resistance are essential.

Write for a copy

SEE OUR CATALOG IN SWEET'S

HENDRICK

Manufacturing Company

Perforated Metals
Perforated Metal Screens
Wedge-Slot Screens
Architectural Grilles
Mitco Open Steel Flooring,
Shur-Site Treads, Armorgrids

46 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

THE ANSWER TO ANY HOT WATER PROBLEM!

Pick

INSTANTANEOUS WATER HEATERS

Proved by PERFORMANCE in

STEEL MILLS
TANNERIES
LUMBER MILLS
RAILROADS
FOOD PROCESSING

CONTROLLED TEMPERATURE AT ANY VOLUME

PICK heaters provide hot water INSTANTLY by steam injection. They're entirely automatic to provide and accurately maintain pre-set temperatures. Exclusive Pressurizer Piston eliminates pipe hammering and shaking. Available in sizes and combinations to provide any volume needed. Installation is simple — requires only ordinary pipe connections.

Write Dept. P-10 for Engineering Details

No Storage Tanks Needed
Compact design permits installation in corners, on walls, or overhead.

Easily Cleaned
No coils. Can be cleaned in a matter of minutes — without dismantling.

MANUFACTURED BY
PICK MANUFACTURING CO.
WEST BEND, WISCONSIN, U.S.A.

Write
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Power's "Reprint Folder"
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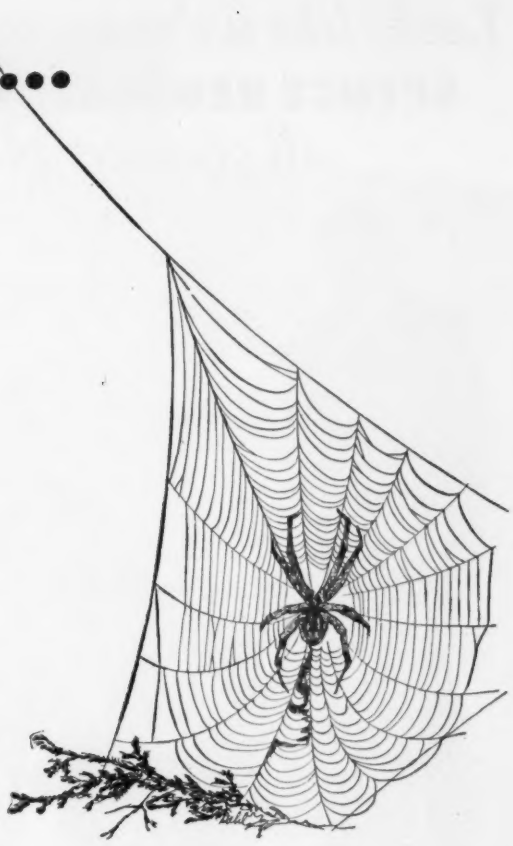
fabricating...



Death to insects, a wonder to children and bane to housewives, spiders perform a kind of garden variety of fabricating. We couldn't begin to compete.

The fabricating we do is with piping and tubing, and must come out just as geometrically accurate as the spider's product. In the case of bent tube type boilers, our skilled operators and equipment turn out tubes which will fit readily into your boilers, no matter how intricate the bends . . . or how many. Our men are trained in precision work, and every tube is carefully checked before it leaves our plant. We know ahead of time that you'll have trouble-free installation, and at minimum cost.

In addition to our boiler tube warehousing, pipe and tube bending and welded fabrication, we are now offering two added services to our customers: an Engineering Department and a complete Machining Department. Our new, larger plant at Catasauqua, Pa. means greater volume and faster production schedules for better delivery.

An unusually large stock of tubes for those emergency repair jobs means no waiting. And, like the web in the picture, our fleet of trucks reaches even distant points with dispatch, meets customers' deadlines on time.

PIPE & TUBULAR PRODUCTS
INCORPORATED
Tubing P&TP *Specialists*

OFFICE: 8504 GERMANTOWN AVENUE, PHILADELPHIA 18, PA.
PLANT: CATASAUQUA, PENNSYLVANIA

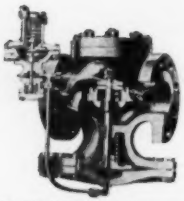
tubing and piping • warehousing and fabricating • engineering and machining

Looks like we're using **SPENCE REGULATORS** *all over our plant*

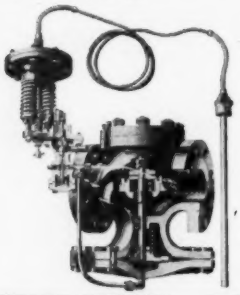
This busy plant has ordered and re-ordered Spence Regulators for two good reasons. (1) Spence offers a *wide-range line* to handle a host of regulating jobs. (2) What's more, Spence units give accurate service year after year. Maintenance is negligible. Over-all costs are low. These design features explain why . . .

- **Single Seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**

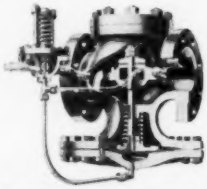
Write for Bulletin 350 for complete details on Spence's line of automatic regulating valves.



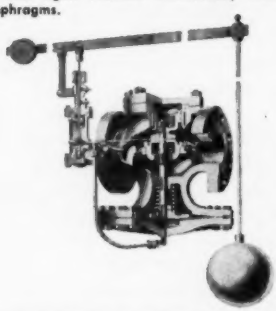
PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes 1/4 in. to 12 in. Pressures to 600 psi 750F.



TEMPERATURE REGULATING — Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.



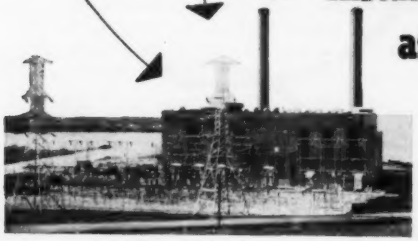
LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

SE 110

SPENCE ENGINEERING COMPANY, INC. Spence
WALDEN, NEW YORK

NAVCO

Installations in Central Power Stations assure Absolute Dependability



FOR almost half a century Navco has specialized in the fabrication and erection of Piping Systems for the highest operating conditions.

The "first" base load Central Station Piping System operating at 1350 lbs. and 900° (back in '30)—the "first" carbon moly to be used in a complete Steam System of Central Station Piping—one of the "first" field x-rayed systems of Steam Piping and one of the "first" Piping jobs to serve a 1,000,000 lb. per hour boiler are among some of the many Navco installations.

Consult Navco for your next Piping job.

NAVCO PIPING

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

NEW YORK • CHICAGO • CLEVELAND • BOSTON • ATLANTA • BUFFALO • CINCINNATI

"... *and be sure to specify* **HAGAN AUTOMATIC COMBUSTION CONTROLS** *because you get...*

... reliable performance, and dependable accuracy."

Rugged and accurate, Hagan Combustion Controls are the best you can buy ... and there is good reason why you should buy only the best.

Waste as little as one per cent of the fuel burned by your boiler during its life, and the cost of the wasted fuel can equal five, or six, or even seven times the original cost of the control system.

That is why you cannot afford anything less than the best—dependable Hagan Combustion Controls.

Our engineers will be glad to discuss all types of combustion control applications with you. For full information, wire, write or call

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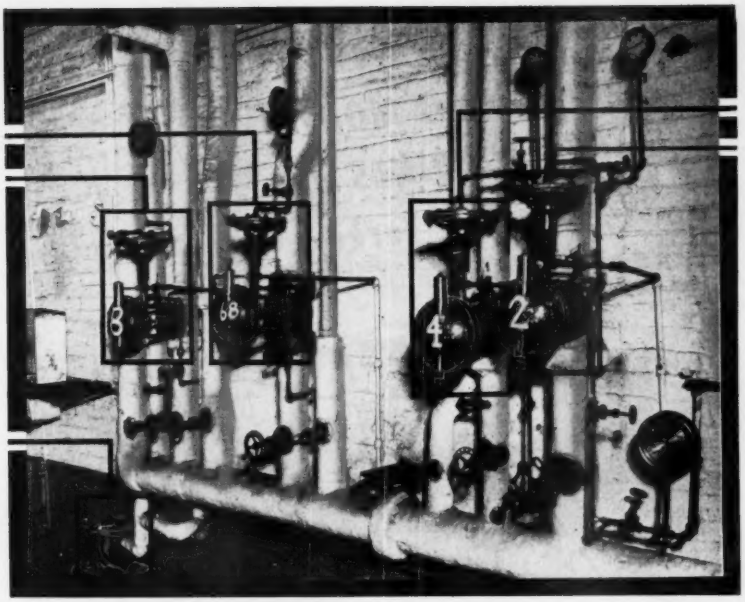
HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING LABORATORIES

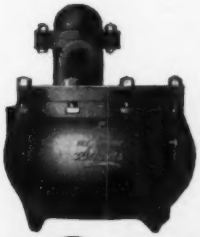


Over 200 Years of Service

without a Major or Costly Replacement

This is the record of achievement for the four SQUIRES Reducing Valves and one SQUIRES Steam Trap as attested by the photograph above. Operating in the plant of the Grabler Manufacturing Company of Cleveland, Ohio, the original installation was made in June of 1907. These five standard units of SQUIRES equipment have been in continuous operation since that date without a major or costly replacement under rugged, demanding working conditions. An individual record for each valve and trap of over 40 years, for a total of over 200 years of continued service.

The low maintenance and record of service is proof of positive, satisfactory performance of SQUIRES Valves and Traps. The trap shown in this installation is draining a line with 125 pounds steam pressure. The Reducing Valves are maintaining a constant delivered pressure of 4 pounds reduced IN ONE STEP REDUCTION from 125 pounds.

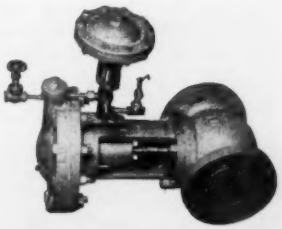


These are some of the reasons why SQUIRES Products are your best investment—initially and in the years to come.

The C. E. SQUIRES COMPANY is pleased to announce the newest addition to their line of equipment—

MOUAT HEATING SPECIALTIES

These include a complete line of thermostatic Radiator Traps, Air Vents, Float and Thermostatic Traps and Boiler Cleaner Compound. For more details on the MOUAT Series and the complete SQUIRES line of equipment, write today for our catalog 100-A.



THE C. E. SQUIRES COMPANY

Over 50 Years of Dependability

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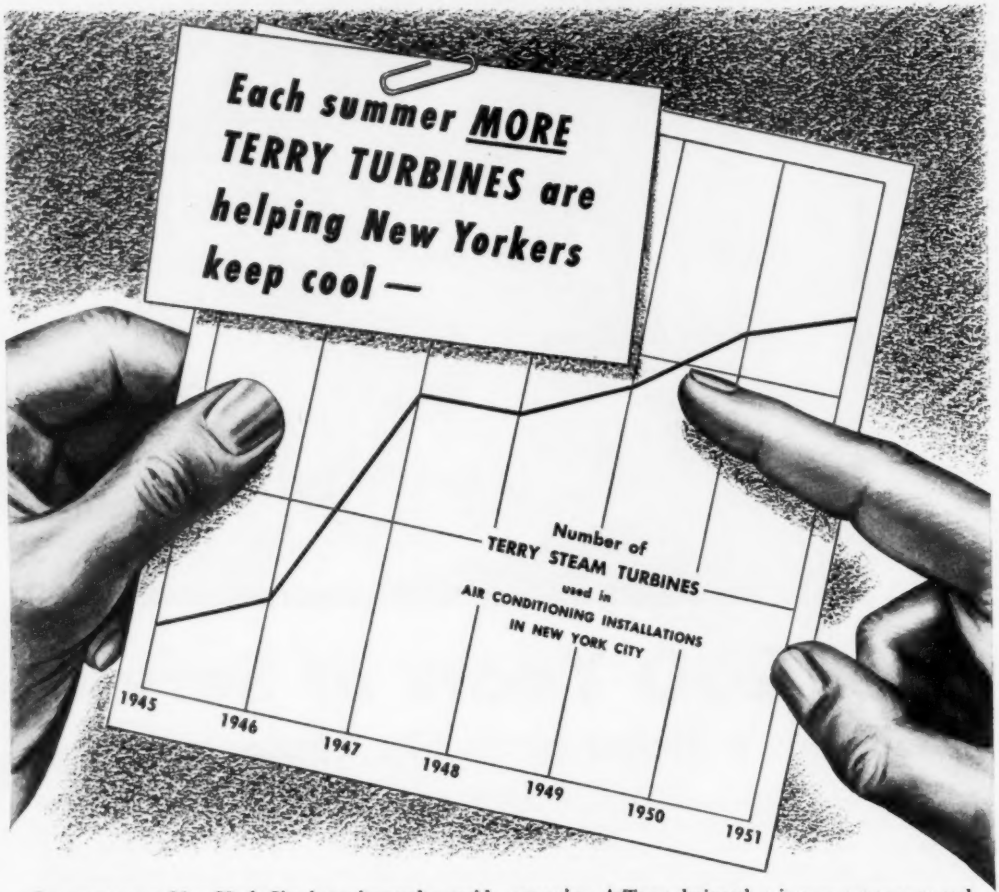

In recent years, New York City has witnessed a rapid gain in the number of air-conditioning installations providing comfort cooling by means of steam. And, as the accompanying chart shows, TERRY STEAM TURBINES have figured prominently in this relatively recent development.

TERRY TURBINES make an ideal prime mover for driving the refrigerating compressor. They respond automatically to the temperature requirements, and will cut back to as little as 15 percent of rating without attention. A Terry-designed unit assures economy and ease of operation.

Before you make a decision on your air-conditioning installation, why not call in a Terry representative? He will be glad to explain the benefits of *comfort cooling by steam.*

PARTIAL LIST OF TERRY TURBINE INSTALLATIONS IN NEW YORK CITY
Best & Co. • Bloomingdale Bros. • Book-of-the-Month Club Carbide & Carbon Building • Federal Reserve Bank • Lord & Taylor • Macy's New York • Madison Square Garden James McCreery & Co. • Mutual Life Insurance • Port Authority Bus Terminal • The 260 Madison Avenue Building

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1192

Get acquainted with Monsanto Santosite and you can say farewell to oxygen corrosion and the costly boiler repairs it causes.

Santosite (sodium sulfite anhydrous, technical) is easy to use . . . safe . . . economical. Santosite removes *all* the oxygen from boiler water by combining with it to form harmless sodium sulfate. Neither Santosite nor sodium sulfate forms sludge. Neither damages boilers or pipes.

Monsanto Santosite is available in small or large quantities from jobbers throughout the country. For information on the use of Santosite in boiler feed water, contact the nearest Monsanto Sales Office or write for Monsanto Technical Bulletin No. O-26. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

Santosite: Reg. U. S. Pat. Off.

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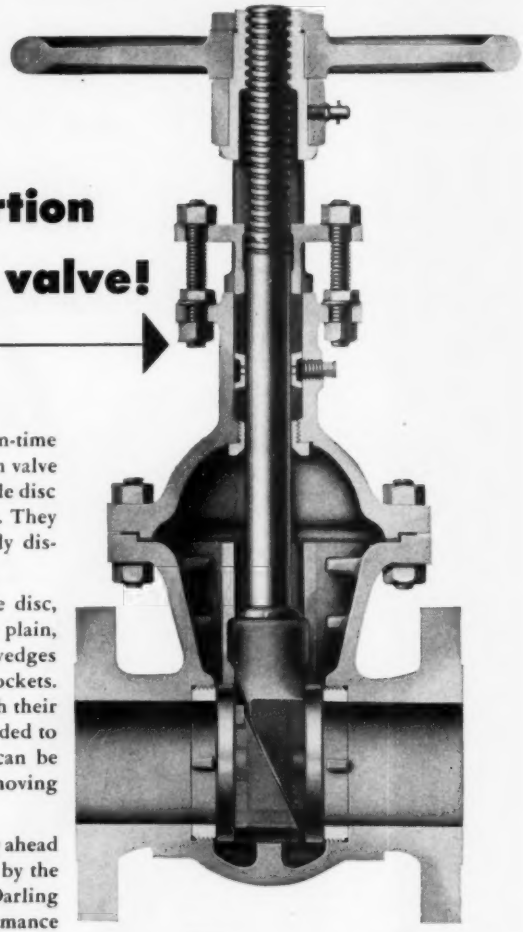
CHEMICALS — PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

DARLING VALVES

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

Valve body distortion no problem for this valve!



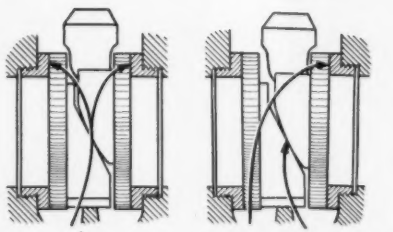
DON'T let costly valve maintenance and down-time headaches get you down! Lick these common valve troubles by installing Darling fully revolving double disc gate valves, with their unique wedging principle. They adjust *automatically* to compensate for valve body distortion—cinching tight, leak-proof closure.

The difference is in the fully revolving double disc, parallel seat principle of Darling valves. Just two plain, interchangeable no-pocket discs and two rugged wedges do all the work. Discs are completely free of pockets. Sediment and scale cannot collect to interfere with their free movement. No links or other devices are needed to hold the discs and wedges together. Any part can be quickly and inexpensively replaced without removing valve from the line.

It's easy to see why Darling valve users are money ahead because of the exceptional service made possible by the Darling design. That's why in plant after plant Darling gate valves are giving longer, trouble-free performance with minimum attention.

Darling features add up to gate valve service at its low-cost best! Send for the free Darling Valve Bulletin, today.

NOTE: Darling gate valves are made in a wide range of sizes, types and constructions, including solid and slotted taper-seat wedge types for all kinds of normal and corrosive services in pressures up to 1500 pounds.



Discs and seats are parallel. *Seats are forced out of parallel by body distortion but discs adapt themselves to give positive closure.* *Radiused face of wedge allows discs to adjust tightly against both seats.*

DARLING VALVE & MANUFACTURING CO.

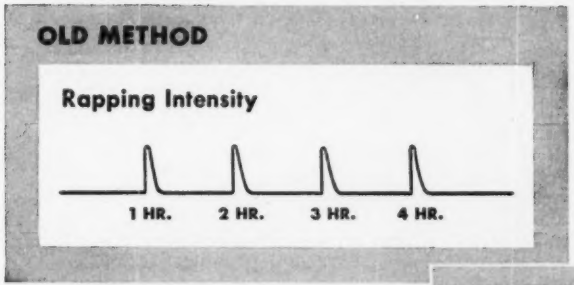
Williamsport 18, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd. Galt 19, Ontario

New Development

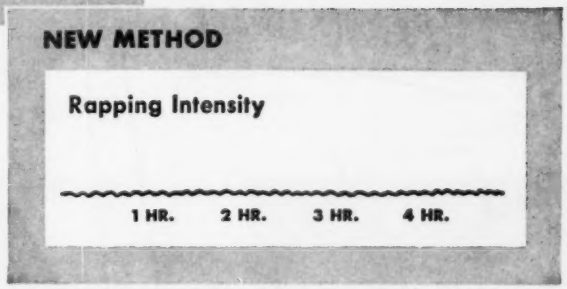
FOR ELECTRICAL PRECIPITATORS

ELIMINATES RAPPING PUFFS



Old Method of Rapping Resulting in Rapping Puff

Here are two simple diagrams that clearly demonstrate the importance of the new method of rapping developed by Research Corporation. The first shows the old way in which dust is shaken loose from electrodes at *periodic* intervals, causing intermittent puffs or clouding.



New Method of Continuous Rapping Eliminating Rapping Puffs
Rapping Intensity

This second diagram illustrates the new scientific method of cleaning electrodes. It involves continuous or sequential rapping, every minute or less, at a controlled vibrational intensity. This converts precipitation from a batch operation to a *continuous and uniform process.*

This is another major contribution by Research Corporation to the field of electrical precipitation. Constant research and development work for the past 39 years has resulted in many other improvements over the first Cottrell Precipitator. These advances plus the unequaled experience gained through over 1000 installations, listed at right, assure you of a profitable solution to your specific problem.

RESEARCH CORPORATION INSTALLATIONS

55 Carbon Black Plants
208 Metallurgical Installations
215 Acid Plants • 34 Paper Mills
293 Detarring Installations
251 Power Stations
86 Steel Plants • 114 Oil Refineries
and Miscellaneous Installations

Want to know more about the new Rapping System? Bulletin FA contains additional data. Send for your copy.

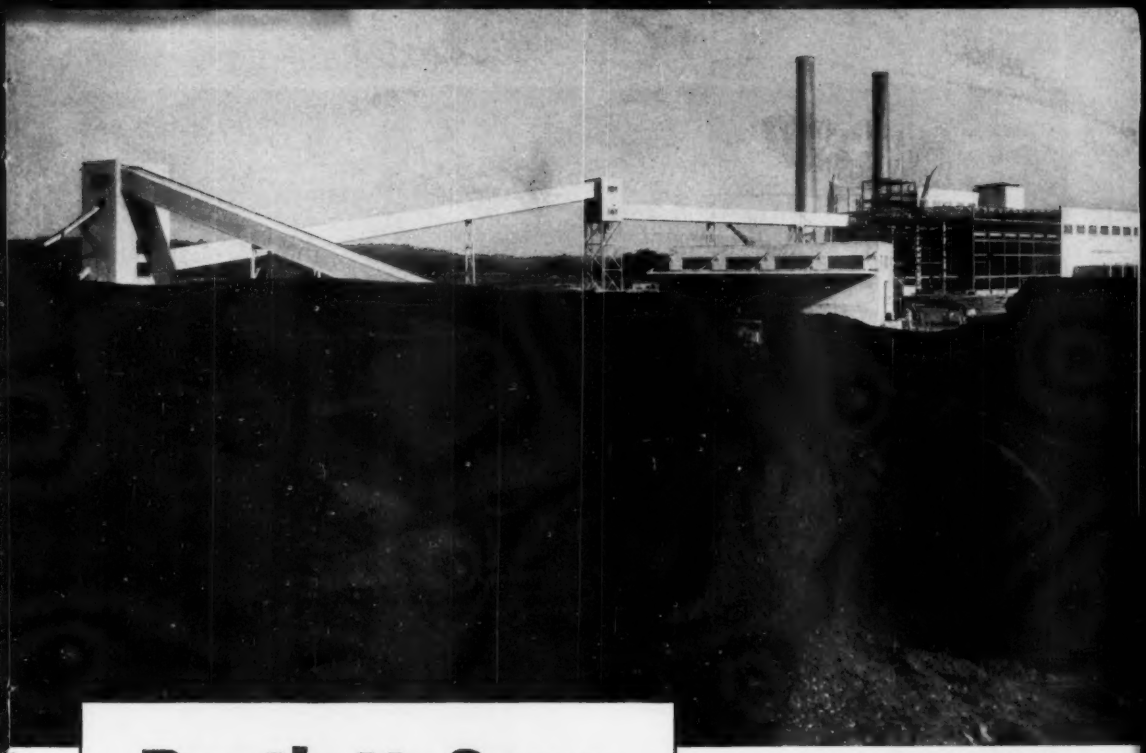
RESEARCH CORPORATION

405 Lexington Avenue, New York 17, N. Y.
122 South Michigan Avenue, Chicago 3, Illinois
Bound Brook, New Jersey

IT'S YOUR LIGHT OF LIBERTY KEEP IT BRIGHT

QUALITY
YOUNGSTOWN
SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
GENERAL OFFICES . YOUNGSTOWN 1, OHIO
Export Offices - 500 Fifth Avenue, New York City
Manufacturers of
CARBON . ALLOY AND YOLOY STEELS

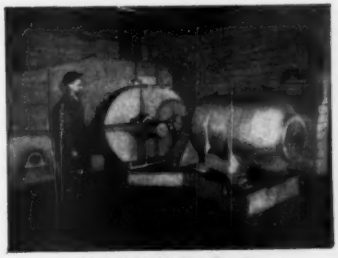


General View of O. H. Hutchings Station
Dayton Power and Light Company
Ebasco Services Incorporated
Consulting Engineers

Bartlett-Snow coal handling at Dayton

The view above shows the first 120,000 KW unit of a plant which will be extended into a 360,000 KW station. The track and reclaiming hoppers, apron feeders, the three 700 ton per hour belt conveyors that total 1,178 feet in length, gates, chutes, and transfer points were detailed and fabricated in our shops and installed by our erectors to Ebasco Services Incorporated's specifications. For maximum efficiency and fixed unit responsibility, let the Bartlett-Snow coal handling engineers work with you on your next job.

Gates and Apron Feeders Under
Track and Reclaiming Hoppers

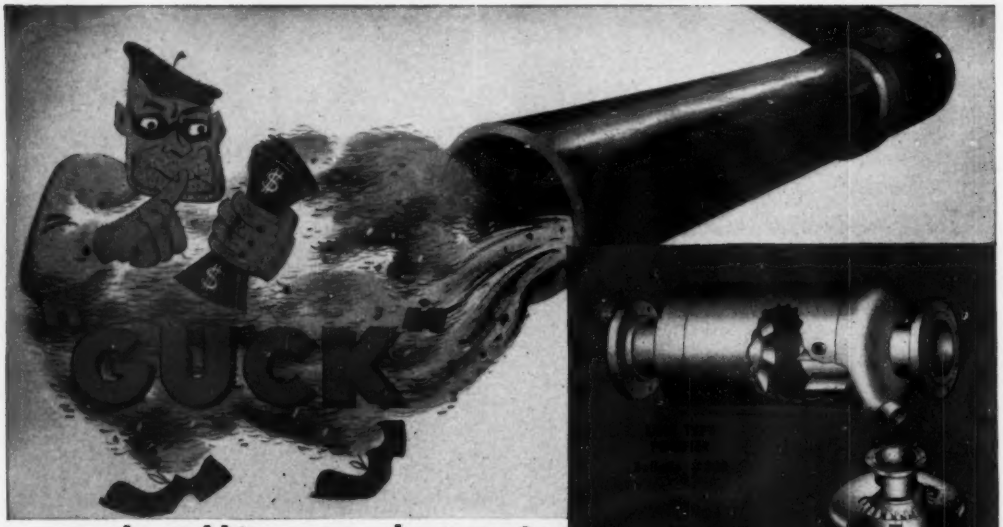


Drive For 700 Ton Per Hour
Belt Conveyor

DESIGNERS
ENGINEERS
FABRICATORS
ERECTORS

BARTLETT-SNOW
CLEVELAND 5, OHIO

"Builders of Equipment for People You Know"



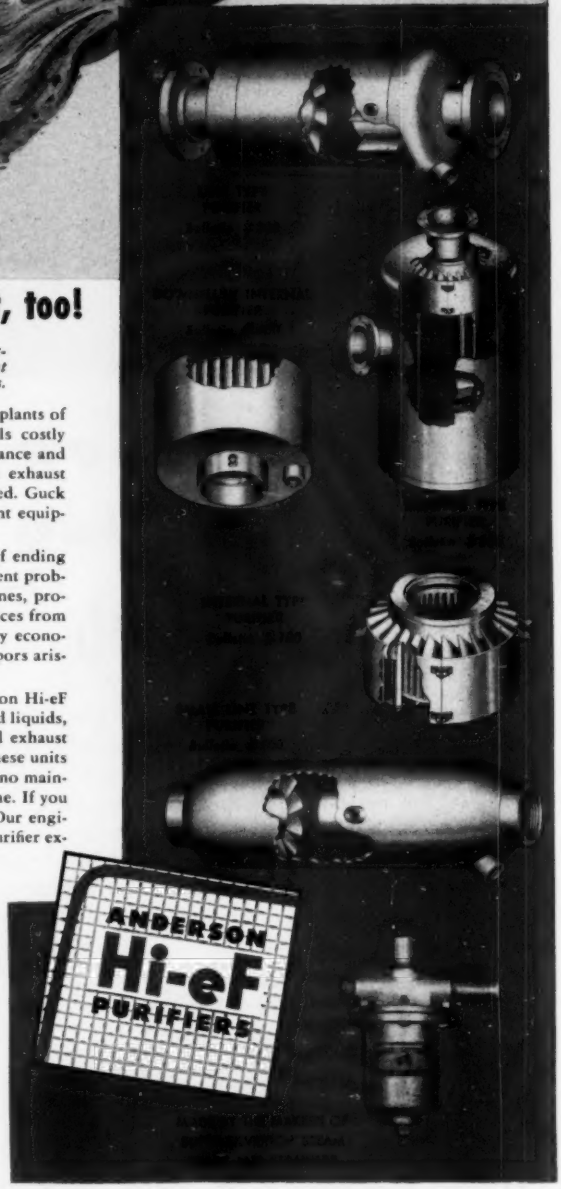
may be robbing your plant, too!

Guck is sludge, oil, line scale and other objectional entrainment in pipelines and equipment handling steam vapor, compressed air or gases.

For years "guck" has been robbing the industrial plants of America! Guck in exhaust gases and steam fouls costly equipment, causing downtime, increased maintenance and reducing efficiency. Guck in many cases makes exhaust steam so objectionable that it cannot be reclaimed. Guck vented with spent gases and vapors damages plant equipment and buildings.

Anderson Hi-eF Purifiers are the one sure way of ending not only "guck" but all steam and vapor entrainment problems. They clean up compressed air and steam lines, protect production and steam equipment, stop nuisances from vented gases and steam. In processing plants they economically reclaim the valuable solids in gases and vapors arising from the materials as it is processed.

The unique centrifugal element design of Anderson Hi-eF Purifiers is guaranteed to remove 99% of entrained liquids, solids, condensate, oil and greases from live and exhaust steam, processed gas, air and chemical vapors. These units cost much less than you might expect . . . require no maintenance . . . are self cleaning . . . and last a lifetime. If you you have a "guck" problem write to Anderson. Our engineering staff, with an impressive background of purifier experience, will gladly solve your problem.



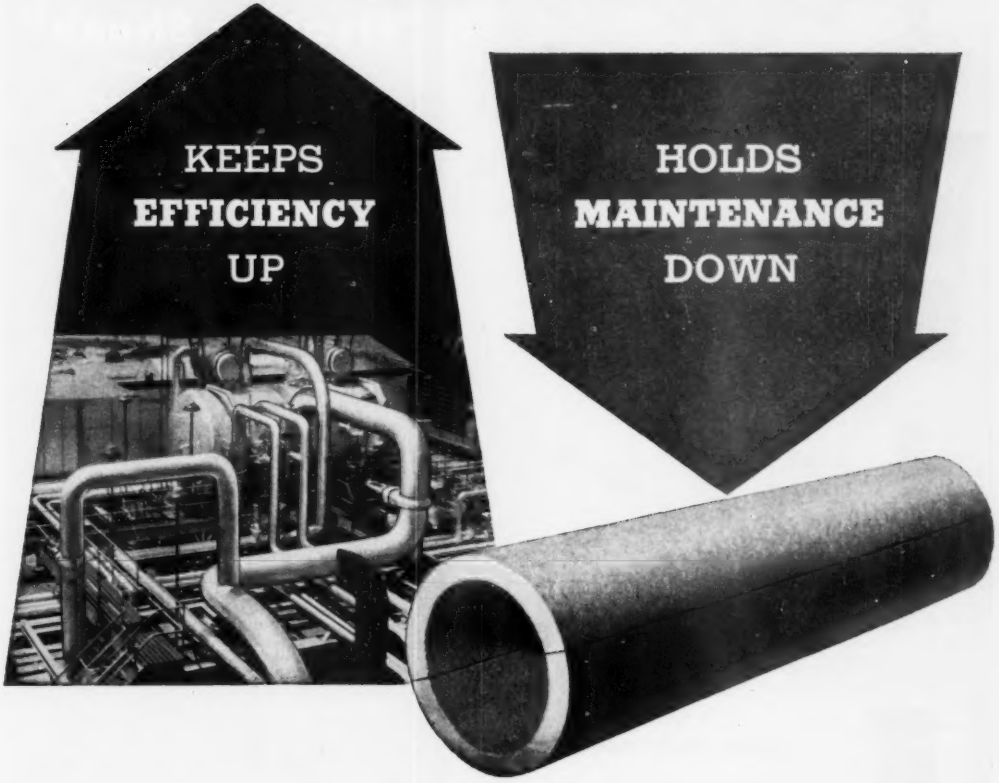
PURIFIER DIVISION,
THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland 2, Ohio

Gentlemen: Please send additional information on Anderson Hi-eF Purifiers described in:

☐ Bulletin #100 ☐ Bulletin #300 ☐ Bulletin #500
☐ Bulletin #200 ☐ Bulletin #400

Name .....
Company .....
Address .....
City ..... Zone .... State .....

UNIBESTOS®



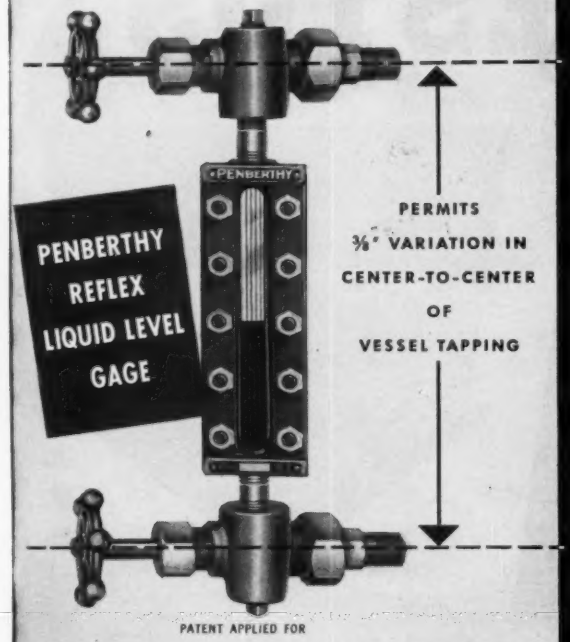
Write for Bulletin No. 76-109, and the name of the Unarco Warehousing Distributor in your area.

Want to reduce heat-loss, surface temperature, and *maintenance costs*—all at the same time? You can, with Unibestos! And you can get stock delivery from your Unarco Distributor in cylinders, half-rounds, or blocks. When temperatures go as high as 1200° F., specify Unibestos No. 1200—and Unibestos No. 750 for up to 750° F., maximum. Or, where temperatures won't run over 600° F., ask for Unarco Amocel—it has many of the same excellent features. Unibestos and Amocel are easy to install, stay put, resist all service hazards.

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. C-9, 332 SOUTH MICHIGAN AVE • CHICAGO 4, ILLINOIS



PATENT APPLIED FOR

PENBERTHY "Floating Shank"

Saves Time and Money in Gage Installation

A feature available only on Penberthy drop forged steel (and alloy) gage valves, the "floating shank" automatically compensates for as much as ⅜" variation in the center-to-center distance of the vessel tapping. This saves time and cuts the cost of gage installation . . . eliminates stresses often induced during mounting. Penberthy "floating shank" is available at slight additional cost. It will pay you well to specify "floating shank" on your next gage order.

Another PENBERTHY First

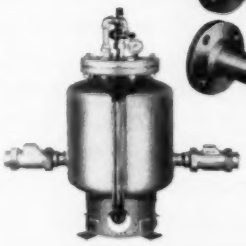
OTHER PENBERTHY PRODUCTS

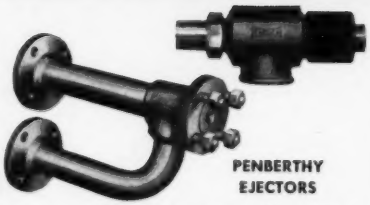
PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.

PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.





PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

4671

PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*

THE PEERLESS TYPE A *Continuous Duty General Purpose* PUMP

General Characteristics • **SINGLE STAGE HORIZONTAL SPLIT CASE DESIGN**

DOUBLE & SINGLE SUCTION (Double Suction Sizes 1¼" through 48"; Single Suction Sizes 2" & 3")

BOTTOM SUCTION (Bottom Suction Sizes 12" through 42")

BALL BEARING

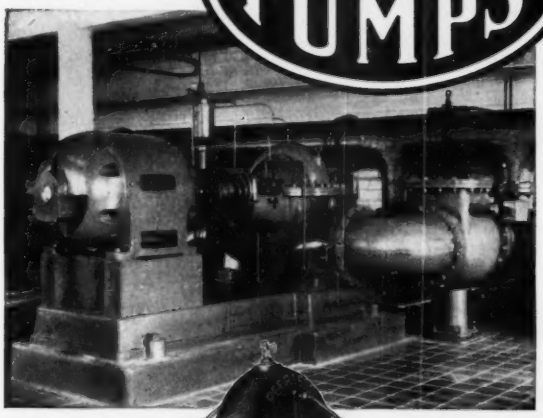
CAPACITIES: Up to 70,000 g.p.m.

HEADS: Up to 300 feet.

DRIVES: Direct-connected electric motor; belted drives; diesel, natural gas, and gasoline engine; steam turbine; combination drives.

TEMPERATURES: Handles liquids up to 300° F.

PEERLESS PUMPS



A popular size Type A, viewed from the discharge side. The horizontally split case permits easy access to rotating elements without disturbing pump alignment or piping.

PEERLESS PUMPS fmc

TYPE A *for All purpose pumping*

Peerless Type A pumps can be used in the widest variety of general pumping services, handling clear water and light alkaline fluids, where no solids are in suspension. Applications vary from pumping water for cooling engine jacket water, to providing plant water supply.

TYPE A *for Advanced design*

Peerless Type A pumps are of the ball bearing type with horizontally split casings, for ease of inspection and maintenance. All are furnished with double suction impellers except in three small sizes where single suction design is employed. Bottom suction can be furnished in all sizes from 12" through 42".

TYPE A *for All capacities and heads*

Peerless Type A pumps offer users greatest range in capacities, delivering up to 70,000 g.p.m. Type A characteristics permit pumping against heads up to 300 feet. Liquids of temperatures to 300°F. can be safely handled.

TYPE A *for Ample safety factor*

The mechanical design of the Peerless Type A pump is as superior as its hydraulic characteristics. Oversize shafts, heavy duty ball bearings, modern design wear rings and shaft sleeves all contribute to ample protection against wear, afford a high factor of safety in operation and assure reliable service and extended pump life.

TYPE A *for Accuracy in construction*

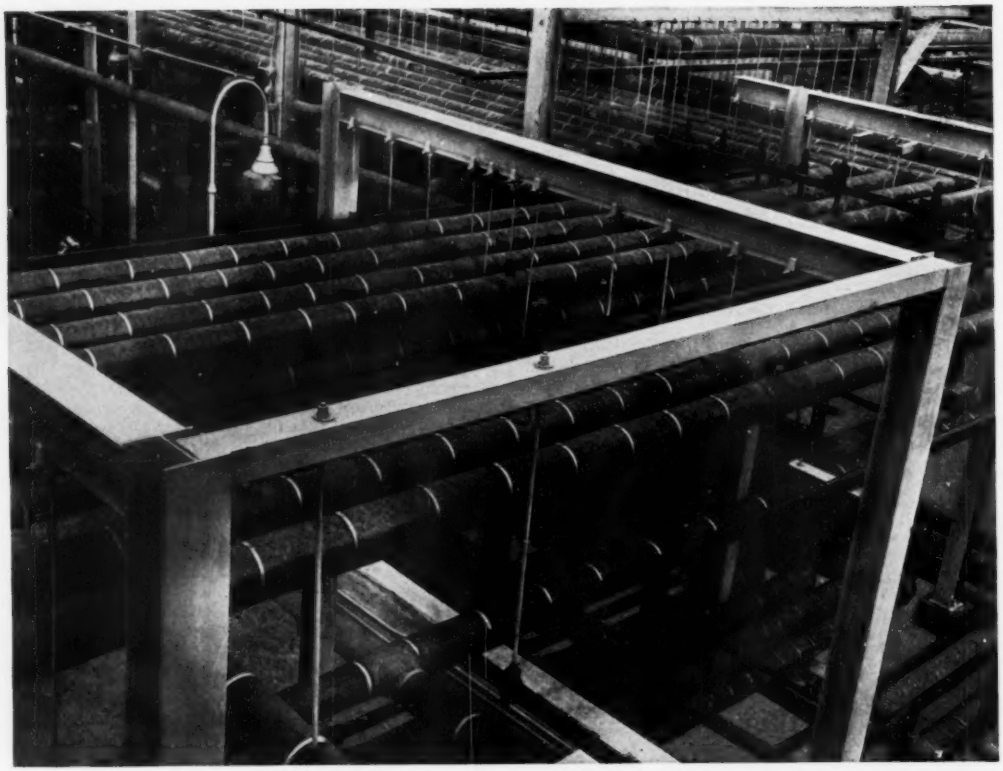
Careful attention to every detail of design is evident in the Peerless Type A pump. For example, bearing seats are cast and bored integral with the case, assuring permanent alignment. All parts are machined to gauge on an interchangeable part system and are rigidly inspected in process.

TYPE A *for Added service life*

Every Type A pump is fully tested in Peerless' modern hydraulic testing laboratory, which can duplicate the field conditions under which the pump will be used. Experienced Peerless trained engineers located near you are at the service of pump users, architects, contractors, etc., to see that the Type A pump matches or exceeds expectations.

Write for Bulletin B-1300 describing and illustrating Type A pumps in detail.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Address inquiries to Factories at:
Los Angeles 31, California and Indianapolis 8, Indiana
Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico; Tulsa.



Outdoors, too, you can count on

"FEATHERWEIGHT" 85% Magnesia

You don't have to pamper "Featherweight" 85% Magnesia! This versatile, dependable insulation does the same efficient job outdoors as well as indoors, on any heating application up to 600°F.

The photograph above shows a part of one of the largest outdoor installations of its kind. The thousands of feet of pipe in this project carry various liquids and gases at many different temperatures. Some of the lines are traced with steam in ½" iron pipe; other lines are steam jacketed. In every case it is important that critical temperatures be held as closely as possible.

"Featherweight" 85% Magnesia, with a weatherproof covering, is an efficient insulation for this application. It will undoubtedly last the life of the plant—and *never* lose its efficiency!

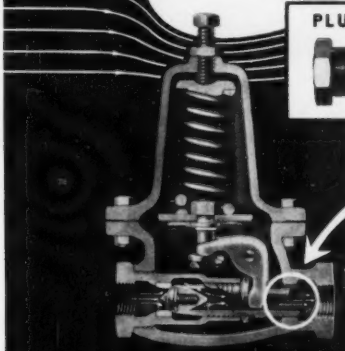
Such service is to be expected of this remarkable material. "Featherweight" 85% Magnesia is structurally strong. It withstands reasonable compression, vibration, and contact. It is physically inert, and its insulating qualities are unaffected by alternate heating and cooling. It is entirely mineral, thus, will not burn. When used along with K&M Hy-Temp Insulation, its usefulness is extended to applications up to 1900°F.

Your Keasbey & Mattison Distributor is an experienced applicator able to answer your questions about "Featherweight" 85% Magnesia. See him, or write us direct for more information.

Nature made Asbestos...
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA
In Canada: Atlas Asbestos Company, Ltd.
MONTREAL • TORONTO • WINNIPEG • VANCOUVER

THIS FLOW PATTERN



PLUS the FLOW TUBE for straightline flow

PLUS the ASPIRATOR which gets the inner valve open wide for peak demand

ARE ALL COMBINED IN THE **CASH STANDARD** *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVE**

to materially cut your valve performance costs

☆

Benefits

- Maximum Capacity when needed most
- Accurate Pressure Control under toughest working conditions
- Trouble-free Service
- Smooth Operation
- Tight Closure
- Accurate Regulation
- Speedier Production Results
- Elimination of Failures
- Constant Delivery Pressure
- Cost Saving Operation
- No Spoilage
- Practically zero in maintenance costs

★

With these three features—all in one valve, you are getting Valve performance that gives you cost saving benefits that begin with the installation and last for years.

☆

First, the streamlined flow around the inner valve; then the straight path for the fluid through the flow tube; then the aspirator which turns small pressure changes into large valve operating forces. These things have made the Streamliner click.

☆

Bulletin 962 features the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve—illustrates the streamlined construction and tells why you get exceptionally long, trouble-free, low-cost performance. Points out why you get no turbulence and therefore can meet peak demand at all times. Explains why straightline flow gives you maximum capacity, close delivery pressure control, and tight closure.

CASH STANDARD CONTROLS.. VALVES

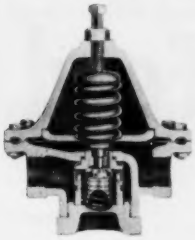
A. W. CASH COMPANY
DECATUR, ILLINOIS

•

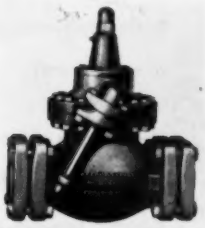
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

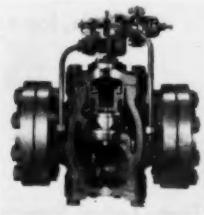
•



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.

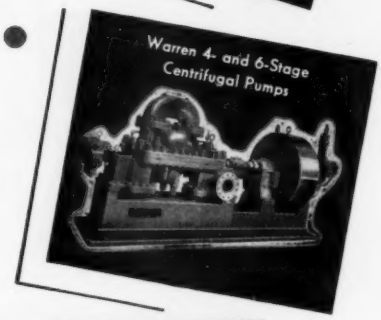


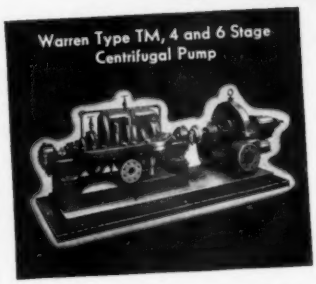
Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

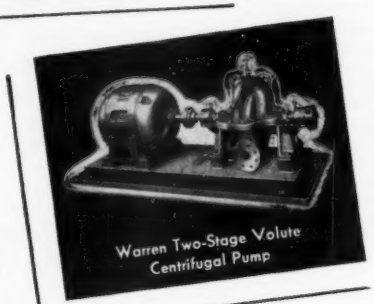


Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

a boiler plant is no more dependable than its Feed pumps....







For well over half a century Warren has specialized in this field and has kept pace with boiler feed requirements as they have developed over the years.

As builders of both Centrifugal and Reciprocating types and for light, medium and higher pressure services, there is a thoroughly dependable Warren Pump to meet a very large part of all boiler feed conditions.
Their on-the-job record has long been one of reliable, low cost operation.

P-28

Time-Tested Experience Indicates it is Good Business

to Specify **WARREN PUMPS**

WARREN
QUIMBY PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

Centrifugal . . . . . Reciprocating . . . . . Rotary

8 BOURDON TUBE MATERIALS

MAKE IT EASY TO SELECT THE RIGHT ASHCROFT DURAGAUGE FOR YOUR PARTICULAR NEEDS

- **Phosphor Bronze**
- **S. A. E. 4130X Alloy Steel**
- **S. A. E. 4650 Alloy Steel**
- **"K" Monel**
- **Type 316 Stainless Steel**
- **Type 347 Stainless Steel**
- **Type 431 Stainless Steel**
- **Beryllium Copper**

Service conditions and requirements determine what Bourdon Tube material is best in the pressure gauges you buy. To insure sustained accuracy and maximum durability in specific installations, Ashcroft Duragauges are available with Bourdon Tubes *in any one of the 8 listed materials.*

All Bourdon Tubes used in Ashcroft Duragauges are extra-wide—have greater sensitivity to slight pressure change. Pulsating pressures 50% higher than the tube rating remove any possibility of tube "set", and all tube joints are stress relieved after assembly. You can select with complete confidence that your Duragauges will serve accurately under the working pressures and corrosive conditions common to your operations.

Ashcroft Duragauges have other features important to you. The Nylon Movement* outwears all others. Unusually long tip travel assures greater accuracy of indication. The micrometer adjustment pointer can be reset while on the shaft. Precise recalibration of gauges in the field is easy. Sturdy lifetime cases, in a choice of materials, are available for stem, wall or flush mounting.

The nearby Ashcroft Distributor will gladly help you choose the right Duragauges for your particular service.

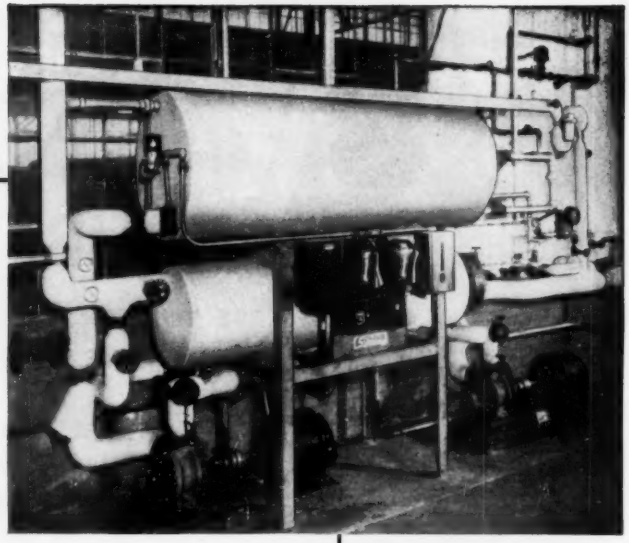
*Patented

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'ASHCROFT' GAUGES, 'HANCOCK' VALVES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

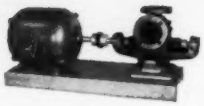
SCHAUB
BOILER RETURN SYSTEMS



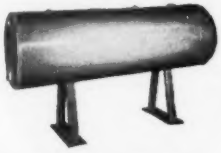
A duplex S5K-D Schaub deaerating type Boiler Return System in modern Chicago industrial plant. Equipment includes Model 2084 feed water heat exchanger, and serves a 200 HP, 200-lb. W. P. boiler.

You Get All These Features ...in a SCHAUB

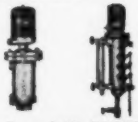
Only Schaub offers you the combined exclusive *money-saving* features illustrated at the right. Any one of these alone would be a sound reason for buying a Schaub System over any other. Take time to compare details. Then you'll quickly see why Schaub gives you *more* for your money on *every* feature. In terms of real savings—you get improved operating economy, lower maintenance costs and longer equipment life. All this means your return system costs you less per year. Know the facts and you'll readily recognize that a Schaub Boiler Return System is your best value.



Schaub Master-Bilt Turbine Pump
Patented fleximatic shaft seals and pre-lubricated ball bearings mean no packing and no greasing—ever! When you install a Schaub Master-Bilt Pump, you can forget about it.



Chromosoid-Lined Receiver
10-year guarantee against corrosion. Schaub engineers developed Chromosoid lining by working with leading chemical researchers. You're protected from costly and premature replacements. No more rust-clogged systems!



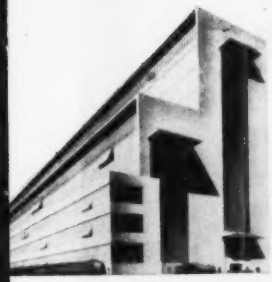
Ultra-Dependable MAGNETROL Boiler Water Level Control
Combination pump-control and low water safety cut-off. Friction-free Magnetrol, assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.

Get the Facts! The complete story of how much more you get when you specify a Schaub System is quickly presented in Catalog 55. Write for your copy NOW—it's free!

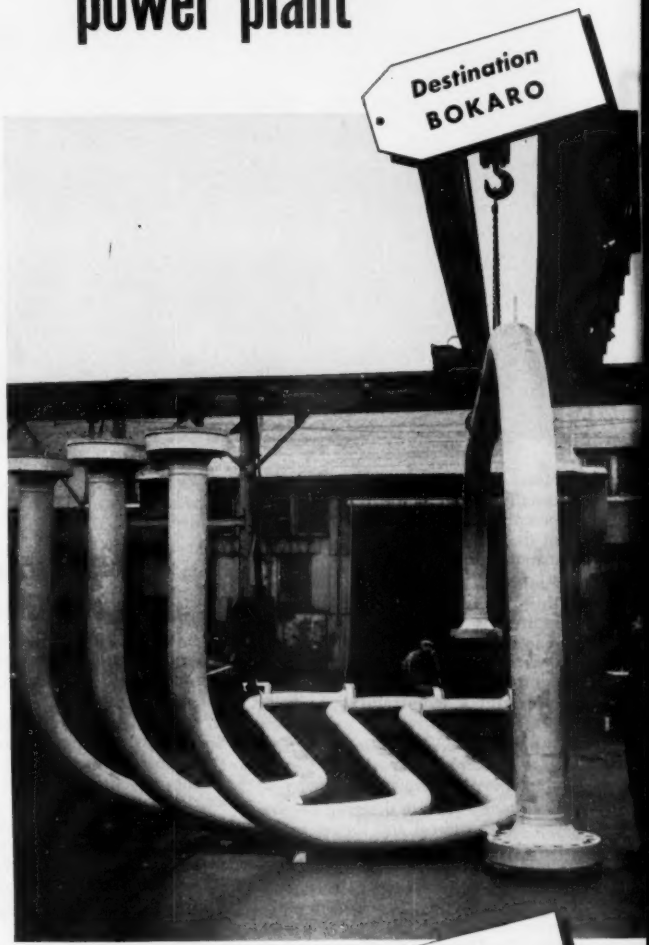
FRED H. SCHAUB ENGINEERING CO.

2105 S. Marshall Boulevard • Chicago 23, Illinois

BLAW-KNOX POWER PIPING used in *INDIA'S FIRST* high-pressure, high-temperature power plant



In the far-off corners of the world—the Philippines, South America and other foreign countries—you will find Blaw-Knox prefabricated power piping. One of the latest is at Bokaro, India, 200 miles northwest of Calcutta, where Blaw-Knox is shipping about 1½ million pounds of power piping for the Bokaro Steam Power Plant. Contractors appreciate Blaw-Knox experience and accuracy when ordering power piping for distant lands . . . they can be sure of trouble-free installation even with unskilled labor. Whether your installation is here or abroad it will pay you to consult Blaw-Knox.



CONTRACTOR: The Kuljian Corporation of Philadelphia. To be operated by the Damodar Valley Corporation.

•

Blaw-Knox Power Piping used throughout. Sections of main steam leads shown at right are fabricated of chrome-moly steel. Lead at right of photograph is 14" diameter; the other three are 10" diameter. Total length of each lead is over 30'.

•

To facilitate installation in the field the piping for the high pressure lines was made with flanged joints.

•

Steam is carried at 975 psi and 950°F.

•

To assure safe transportation of finished sections, Blaw-Knox outlined railroad clearances on large-scale drawings before beginning fabrications.

•

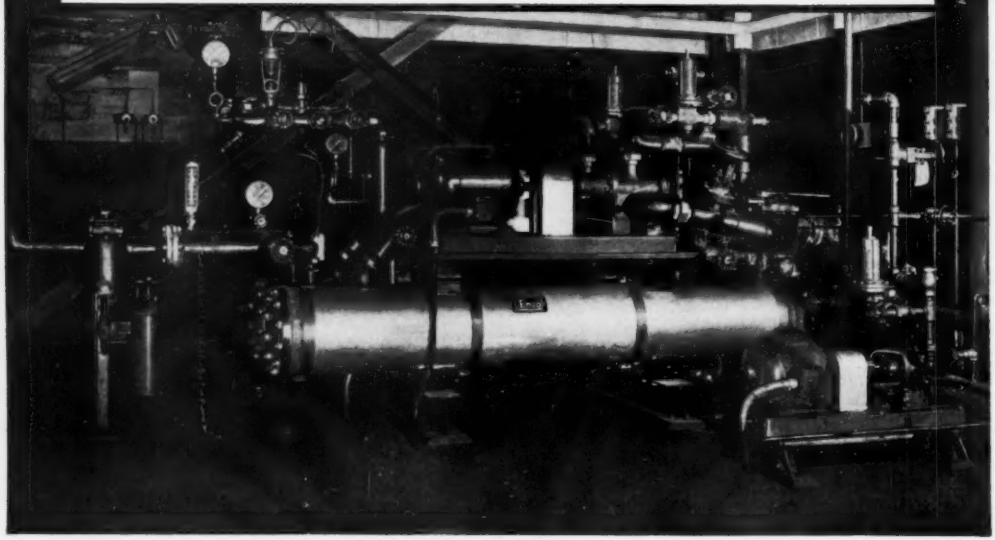
This is the first high-pressure, high-temperature steam power plant to be built in India and will provide power for industrial expansion in the Damodar Valley area.

BLAW-KNOX
CONSTRUCTION COMPANY

1525 Pennsylvania Avenue, Pittsburgh 33, Pa.

POWER PIPING AND SPRINKLER DIVISION

2 separate ENCO Fuel Oil Units Meet Plant Needs



Here is a typical Enco two-unit installation which handles fuel oil pumping and heating requirements in the plant of a building materials manufacturer.

Fuel Oil Pumping and Heating Unit, built with two pumps and two heaters, is designed for continuous plant load service. Capacity is 11 gpm Bunker C fuel oil with one pump or one heater at 300 psig pressure with a temperature rise from 90F to 230F.

Light Oil Pumping Unit for cold start-up service. Capacity is 3 gpm #2 oil at 300 psig pressure.

Enco pump sets are designed to give you easier control and longer maintenance-free operation. They are simple and economical to install. All you need do is to connect to station piping and run. Before shipping, every Enco Fuel Oil Pumping and Heating Unit is completely tested under high pressures. For compiete details on wide-range line, write for Bulletin O B -37.

Only ENCO offers all ten plus features

1. Completely Automatic Operation is assured by automatic temperature and pressure regulation valves.

2. Coordinated Design Saves Space. All equipment essential to the preparation of fuel oil for combustion is eontained in one compact unit.

3. Individually Designed to meet the specific needs of the particular power plant in accordance with its exact operating requirements.

4. All Parts Visible and Accessible for easy operation, maintenance and repair.

5. Pumps and Heaters are interconnected to provide maximum flexibility of operation.

6. Safety Valves protect individual parts where required.

7. Easier Maintenance — Less Service-Time for Cleaning because straight tube, multi-pass heaters with removable heads are used.

8. Pumps Operate at Moderate Speed. Heaters designed to give the correct viscosity and velocity without fouling.

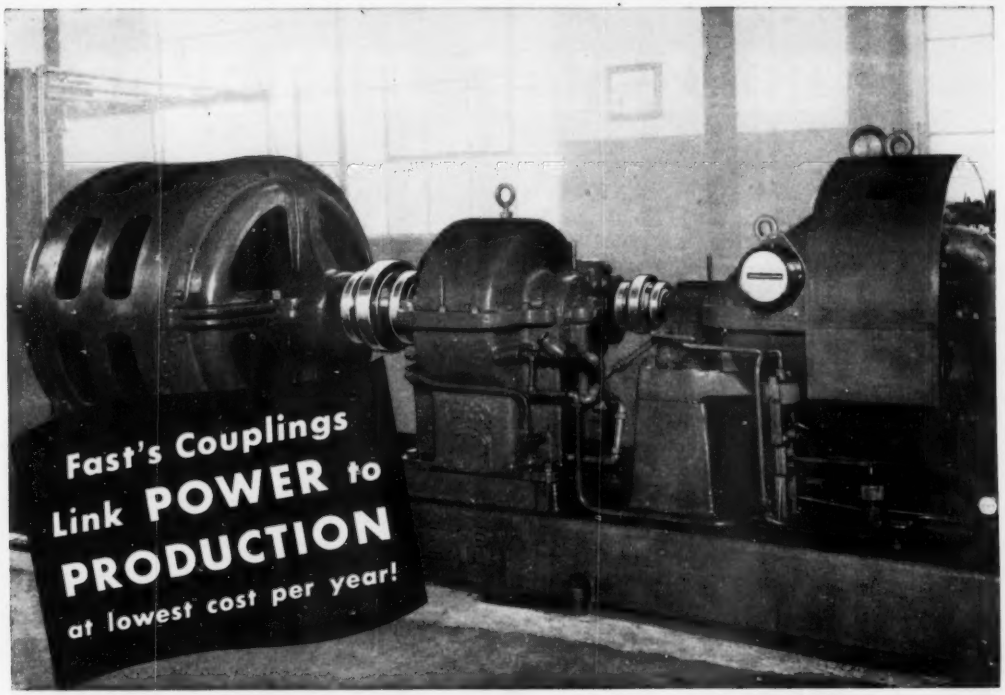
9. Smoother Flow of Clean Fuel to Furnace. Air chamber for each piston pump prevents pulsations—pressure regulator for rotary pumps. Twin type strainers provided to keep atomizer tips from clogging.

10. Cleaner Boiler Room . . . all overflows connected to a common outlet, flanged drip pan catches oil drip.

EC 485

THE ENGINEER COMPANY

75 WEST STREET, NEW YORK 6, N. Y.



Every major producer of high-speed equipment uses FAST'S Couplings!

HIGH-SPEED equipment demands components with superior strength, accurate manufacture, long-lasting dependability. That's why it's important to *you* that Fast's Couplings are selected by every major high-speed equipment producer!

Fast's usually outlast the equipment they connect. Many have been in continuous operation for over 30 years, without trouble of any kind. And Fast's longer life saves you coupling dollars, too, because you amortize their cost over many years of trouble-free operation.

For full details on Fast's Couplings and Koppers Engineering Service, write today for your free copy of our catalog. Send to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 223 Scott St., Baltimore 3, Maryland.

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FAST'S
THE ORIGINAL
GEAR-TYPE
Couplings

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Here's How FAST'S Save You Money

Free Service—Koppers free engineering service assures you the right coupling for the job.

Rugged Construction—Fast's still maintains its original design, without basic change or sacrifice in size or materials. Result: freedom from expensive coupling failures.

Lowest Cost per Year—Fast's Couplings usually outlast equipment they connect. Their cost may be spread over many years!

KOPPERS COMPANY, INC., ***Fast's Coupling Dept.***
229 Scott St., Baltimore 3, Md.

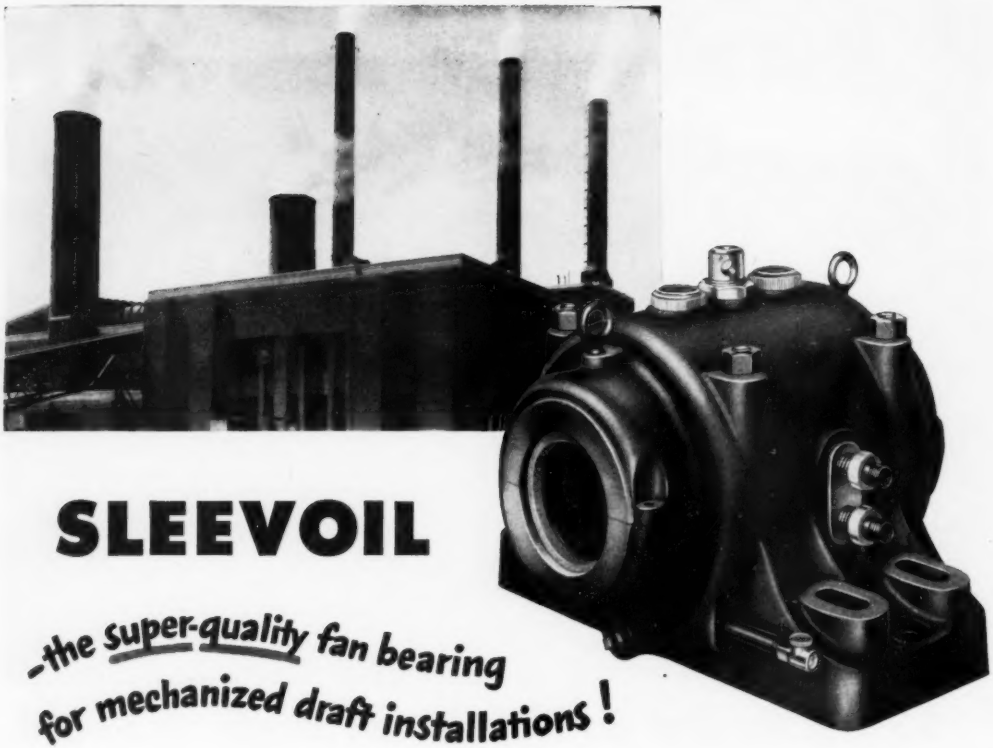
Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....



SLEEVOIL

—the super-quality fan bearing for mechanized draft installations!

● Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

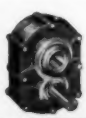
DODGE MANUFACTURING CORPORATION
3200 Union Street, Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

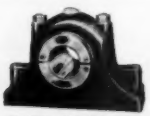
CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on *modern* power transmission machinery for *modern* installations. Look for his name under "Power Transmission Equipment" in your local classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!

SEALED-LIFE V-BELTS; TAPER-LOCK SHEAVES



TORQUE-ARM SPEED REDUCERS



DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

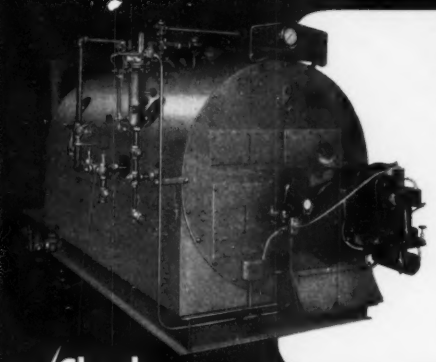
[redacted]

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS

SAVE FUEL-SAVE LABOR-

Choose Dutton!

TWO LINES TO SUIT YOUR NEEDS... BOTH FAMOUS FOR EFFICIENCY... LONG LIFE... LOW OPERATING COST



EconoTHERM...

the compact, automatic "packaged" boiler with exclusive Off-Center Firing

Compare it point-by-point — and you'll see *why* the EconoTHERM's advanced engineering *pays off* in fuel and labor saved! Off-Center Firing results in faster steaming and greater safety with guaranteed 80% efficiency. Completely automatic ... amazingly compact ... 5 or more square feet of heating surface per H.P. Gas or oil fired — to 250 H.P. Write for EconoTHERM Bulletin EC-100C.

Check First with Dutton

OTHER TYPES AND SIZES 5 H.P. AND UP

EconoMIST...

gives you 5-way firing convertibility... plus reliable H. R. T. design

Install it for gas, light oil, heavy oil, stoker, or hand firing — you can later convert the EconoMIST to *any* one of these firing methods. Highly adaptable, it's above all tremendously *dependable*. Of all "packaged" units, EconoMIST sets the standards for operating simplicity and low maintenance costs. Sizes from 15 to 105 H.P. Write for EconoMIST Bulletin EC-100C.

Handy Steam Cost Calculator mailed FREE on request ... or ask your Dutton representative. (See Yellow Pages in Phone Book.)

Dutton BOILERS

DIVISION
HAPMAN-DUTTON COMPANY
KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

LEVER HOUSE

New York City

". . . that Blue-Green Glass Tower"
is another famous
CLARAGE ***installation!***

During the last 40 years Clarage has furnished much of the ventilating and air conditioning equipment installed in office buildings which house America's greatest business enterprises.

A recent installation requiring 27 Clarage ventilating fans is "Lever House," new general offices of Lever Brothers Company.

Lever House provides ideal working quarters for 1280 people. It has every comfort and efficiency advantage which expert planning and modern equipment can provide.

What does American business like about Clarage? . . . first, our resourcefulness in devising ways of meeting your particular requirements exactly — and, second, the ability of our equipment to operate faithfully and economically for a long time to come.

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97 **OF AMERICA'S 100 LARGEST CORPORATIONS are users of Clarage equipment . . . This wide acceptance denotes the high quality and reliable performance of Clarage products.**

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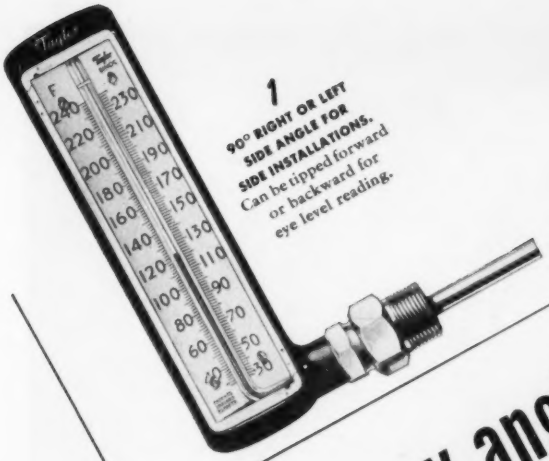
CLARAGE
Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal



1 **90° RIGHT OR LEFT SIDE ANGLE FOR SIDE INSTALLATIONS.** Can be tipped forward or backward for eye level reading.

2 **STRAIGHT INDUSTRIAL THERMOMETER** for inserting on horizontal pipe lines.

From any angle

Easy-Reading Taylor Industrial Thermometers invite frequent readings for better protection of your equipment.

1 **Exclusive,** three-times-easier-to-read BINOC® tube actually invites *frequent* reading.

2 **Extra-bold** black numerals stand out sharply on white background.

3 **Fast, accurate** indications of all temperatures within minus 40° to plus 950°F., or equivalent Centigrade.

4 **Built** to give you many years of rugged, dependable service.

5 **Available** with a wide variety of stems and connections. Write for CATALOG E today!

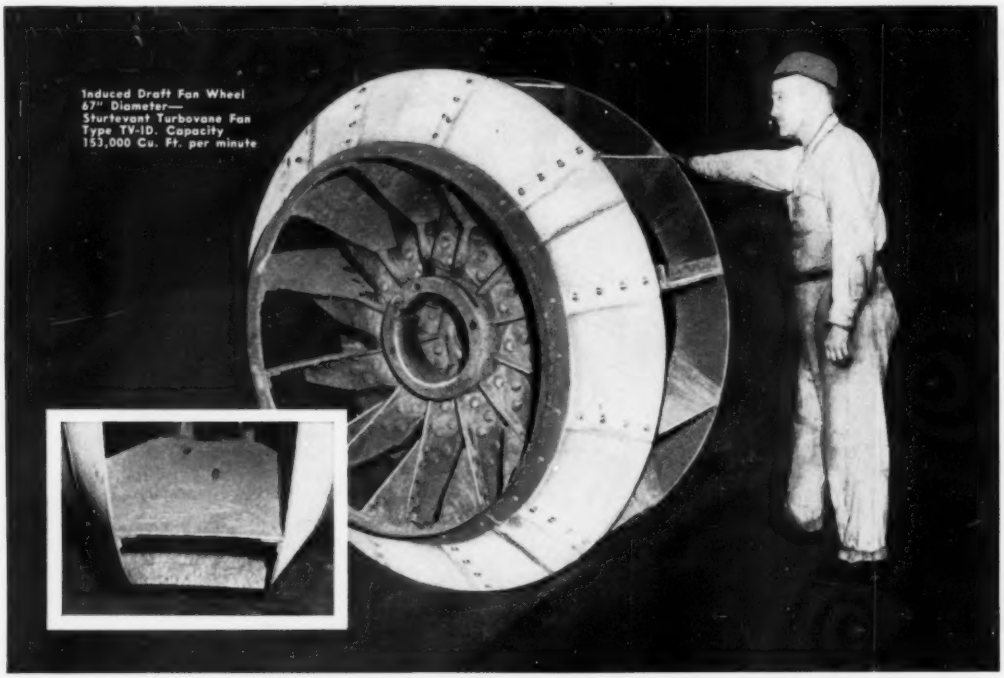
Taylor Instrument Companies,
Rochester, N. Y., and Toronto, Canada.

3 **135° OBLIQUE RIGHT OR LEFT SIDE ANGLE** for difficult locations.

4 **90° ANGLE INDUSTRIAL THERMOMETER** for vertical pipe lines.

Taylor Instruments MEAN **ACCURACY FIRST** IN HOME AND INDUSTRY

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.



LIFE OF ID FAN BLADES HARD-FACED WITH COAST METALS ALLOY INCREASED FROM 4 to 12 MONTHS

2 Weeks Boiler Outage Eliminated With CM-112 Alloy

Maintaining this 67" induced draft fan wheel at New Jersey Power & Light Company's Gilbert Station in Holland, N. J. always meant one week of boiler outage three times a year. Labor involved in removing the wheel, changing over and reblading took two weeks for each overhaul. Now this is done only *once a year* by hard-facing the fan blades with Coast Metals Alloy 112. This has reduced downtime better than 66% and eliminated 2 weeks of boiler outage at the station.

Fly ash in the exhaust handled by the fan not only wears down the blades but also attacks the junction points of the blades and shrouds weakening the assembly. In this severe case of abrasive action, CM-112 applied to the major points of wear has increased equipment life better than 3 to 1. Coated with 250 pounds of CM-112, the fan lasts one year before major overhaul. Minor touchups during the year are made while the fan wheel remains in the housing . . . on the job.

After one year of operation, the fan wheel can be refaced again . . . this time with about 60% less than the amount of CM-112 used in the initial hard-facing, resulting in a further reduction in maintenance costs.

There are many other examples of how CM Alloys extend the life of power plant equipment subject to impact and abrasion: Raymond Bowl Mill parts—coal feeder screws — sluice liner castings — clinker crusher rolls—impact mill plows—ID fan float liner plates, exhauster fan blades, when hard-faced with CM *stay on the job* and continue to perform efficiently *long after* unfaced parts have become too worn to use and must be replaced.

So don't *replace — reface* with CM specialized welding rods. You'll not only keep your plant running with fewer interruptions, but save money. We shall gladly make recommendations based on your particular needs.

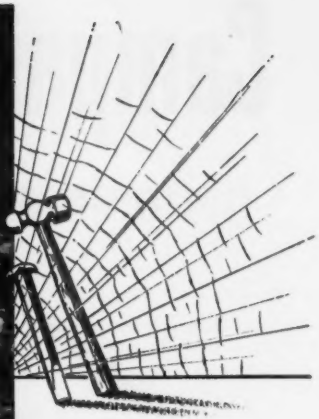
COAST METALS, Inc.

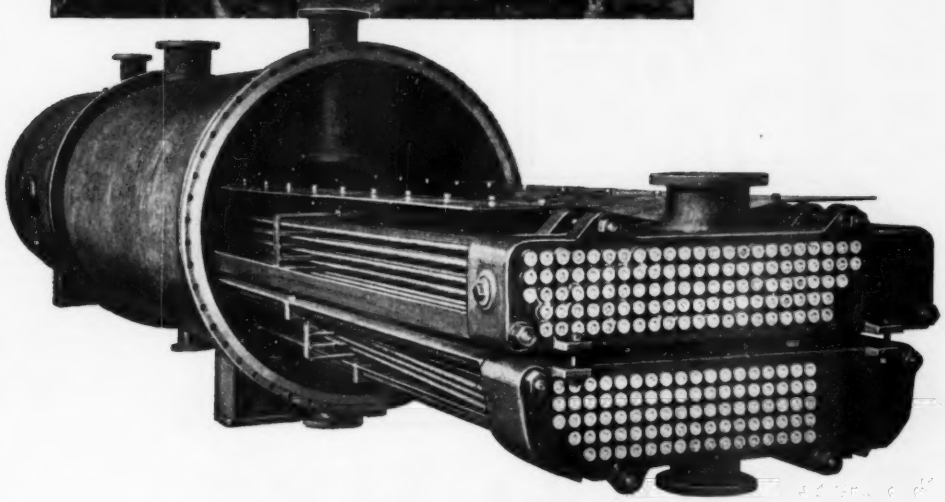
Little Ferry, N. J.

COAST METALS (CANADA), LTD., Hamilton, Ontario

PRODUCERS OF SPECIAL HARD-FACING ALLOYS FOR THE POWER INDUSTRY

SCALE...
no problem in this Evaporator





There's never a need to chisel scales from the tubes of a G-R Bentube Evaporator, no matter how hard your raw water supply may be.

You'll always be free from that chore, because this evaporator sheds scale *automatically* . . . with each change in temperature of its exclusive Bentube elements.

And these units have many additional distinctive features that assure pure dry vapor, minimum steam pressure drop, and special maintenance conveniences.

The definite Bentube Evaporator guarantees of vapor capacity and extreme purity are based on the unequalled G-R experience of more than 50 years in building evaporators for central power generating stations, industrial plants and vessels of every type.

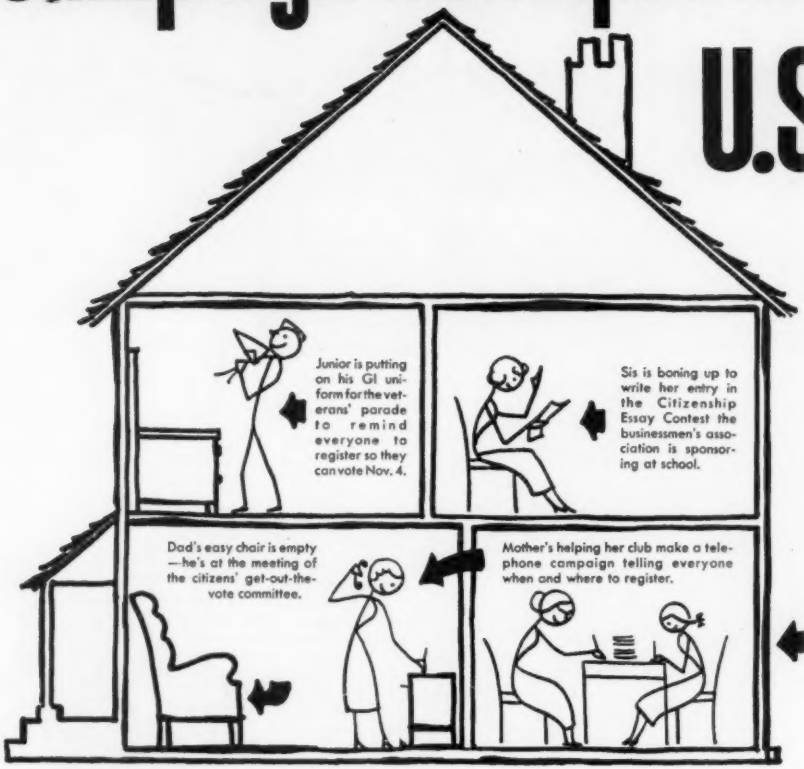
Write for bulletin describing these units in detail.

THE GRISCOM-RUSSELL CO., MASSILLON, OHIO

G-R HEAT TRANSFER APPARATUS **Bentube Evaporators**

GR 291

Campaign Headquarters U.S.A.


Junior is putting on his GI uniform for the veterans' parade to remind everyone to register so they can vote Nov. 4.
Sis is boning up to write her entry in the Citizenship Essay Contest the businessmen's association is sponsoring at school.
Dad's easy chair is empty—he's at the meeting of the citizens' get-out-the-vote committee.
Mother's helping her club make a telephone campaign telling everyone when and where to register.
Grandma's sending registration reminders to all the church members. Even little Sis is helping—rubber-stamping messages on the cards.

The Family Vote will elect the Next President

NOT THE FARM VOTE...
THE BIG-CITY VOTE...
THE LABOR VOTE...
OR ANY PARTY VOTE...

Politicians talk a lot about this and that "bloc" of voters being decisive factors in this election. So do all the pollsters. You can't blame them for trying to dope it out that way in advance . . . but . . .

YOU know you're going to vote your own sweet way when you get behind that voting booth curtain—that where you live or work hasn't got a blankety-bloc thing to do with how you'll vote. You'll vote for what you believe to be in the best interests of your family—your kids—and your kids' kids.

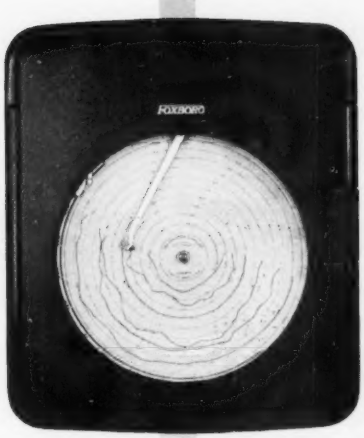
So YOU know that this year—as always—it will be the FAMILY vote that really decides things. And families are working as never before to make sure every American votes. Right now in millions of American families, everyone from Little Sis to Grandma is pitching in to remind every eligible American to register to make sure of the opportunity to vote. And then they'll tackle the job of getting out the vote of every member of America's 44,000,000 families. They're the biggest "bloc" in America—they ARE America!

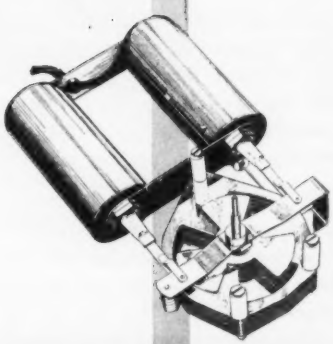
If your family is already working at the job—congratulations! If you aren't, talk it over at supper tonight, and pitch in tomorrow.

No other instrument

for recording pH or conductivity

offers this cost-saving combination





1. Six-point recording on a single round chart

2. Freedom from slidewire limitations

HERE'S THE IDEAL MEANS of recording pH and conductivity in boiler water, condensate, make-up water and circulating water. The Foxboro Multi-Record Dynalog* can measure and record up to 6 points on conductivity . . . or 6 points on pH (with only 1 pre-amplifier). It uses convenient circular charts . . . easy-to-read, economical-to-use. A substantial saving in initial cost of instruments is also assured.

IN ADDITION, Dynalog Instruments have *no slidewire,* no contacts to stick, wear or corrode. Maintenance is practically eliminated. Because of their completely electronic design, these instruments offer new standards of sensitivity, speed and accuracy . . . proven process improvers, cost-savers and trouble-savers. Here's your opportunity to step up plant operating efficiency. Get complete details now. **The Foxboro Company, 689 Neponset Ave., Foxboro, Mass., U. S. A.**

*Reg. U. S. Pat. Off.

Here is the unique, simple rotary-capacitor balancing device of Dynalog Instruments. Its sensitivity is not limited by turn-to-turn winding of slidewire. Balancing is completely STEPLESS as well as continuous. It requires no high speed motor, no galvanometer. Advanced electronic design also eliminates dry cell batteries . . . no standardizing. The simplest potentiometer ever built!

FOXBORO
REG. U. S. PAT. OFF.

RECORDING · CONTROLLING · INDICATING INSTRUMENTS

FACTORIES IN THE UNITED STATES CANADA, AND ENGLAND

heavy stuff becomes light-weight aggregate

You can tell by the close spacing of the hoops on this 16 x 50 ft. Neff & Fry Silo that the material stored is very heavy. The silo, when filled, holds 450 tons of perlite, the raw material for Permalite—a light-weight aggregate made by The Great Lakes Carbon Co.

Our folder, "Bins With the Strength of Pillars," explains how Neff & Fry Super-Concrete Staves are made to give them rocklike density and extreme crushing strength.

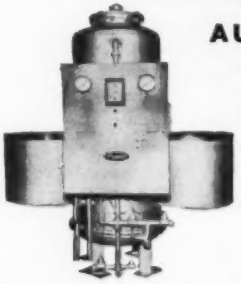
If you handle any flowable bulk material, it will pay you to read our folder. Ask for a copy now while you're thinking of it.

THE NEFF & FRY COMPANY
270 Elm St., Camden, Ohio

NEFF & FRY SUPER-CONCRETE STAVE STORAGE BINS

HIGH PURITY WATER

For Boiler Feed, Process & Other Needs



COMPLETELY AUTOMATICALLY*

Operating on the most efficient deionizing technique known (intimately mixed cation and anion exchangers in a single unit tank), raw water passes through a Penfield Automatic Mono-Column Demineralizer only once — *yet comes out with resistances reported as high as 20,000,000 ohms.* No heat or steam power is ever required and there are no valves to operate. Even regeneration is accomplished completely automatically by the simple flip of a single switch.

*The new Penfield Mono-Column Demineralizer pictured above performs all its operating functions completely automatically — even recuts in effluent when proper preset purity is reached after automatic regeneration. Write for full information on units of any desired capacity up to 10,000 gph.

PENFIELD MANUFACTURING CO., INC.
19 High School Ave., Meriden, Conn.
FILTERS · SOFTENERS · DEGASIFIERS · DEMINERALIZERS

Penfield "Planned Purity" PAYS!

Many CLEAR WATER Pumping Problems *Cleared Up—* in these bulletins!

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Fig. 1561 W. E.—150-pound Cast Steel Swing Check Valve with welding ends and bolted cap.

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Fig. 1314-A—1500-pound Steel Integral Bonnet "Y" Valve with socket weld ends. Sizes ½" to 2", incl.

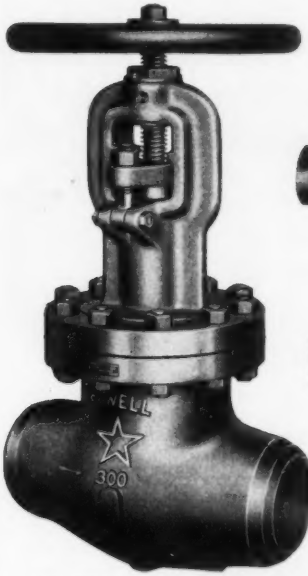

Fig. 3031 W. E.—300-pound Cast Steel Globe Valve with welding ends, outside screw stem and bolted flanged yoke.

Fig. 1333-A—Steel Integral Bonnet Angle Valve for 1500 pounds W. P. Socket weld ends. Sizes ½" to 2", incl.

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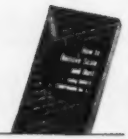

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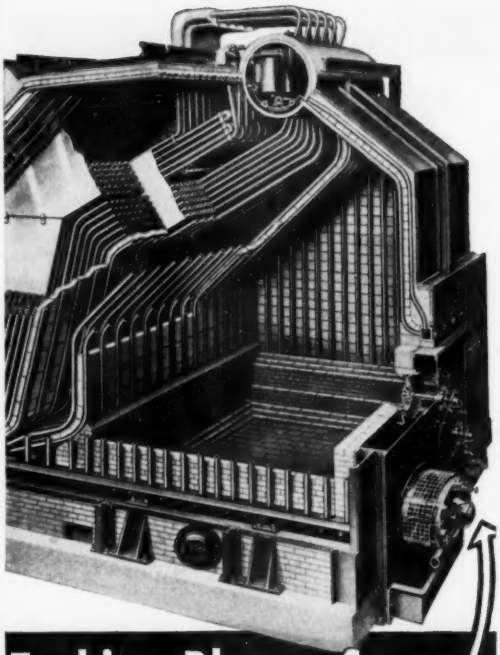

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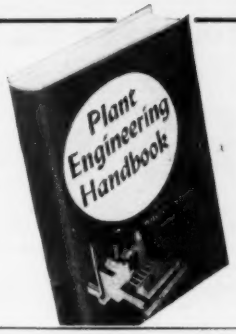

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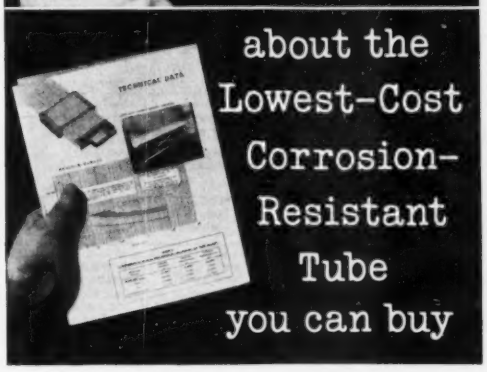

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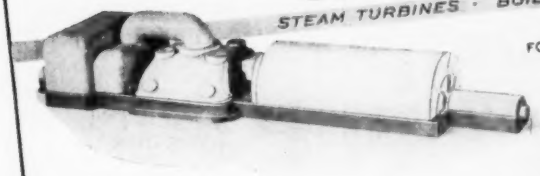

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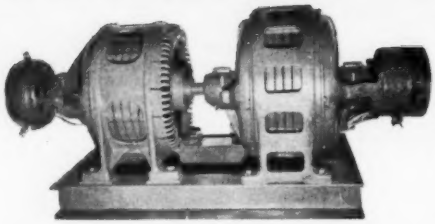

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600	G.E.	Sq. cage	6600/4000	1800
500	G.E.	Sq. cage	440	3600
500	G.E.	Synch.	440	900
500	G.E.	Slipring	220/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
350	G.E.	Slipring	440	720
300	G.E.	Slipring	220/440	600
300	G.E.	Sq. Cage	220/440	1200
300	G.E.	Sq. cage	2300	1800
300	Whse.	Synch.	2200/440	600
300	G.E.	Slipring	2300	1800
300	Al. Ch.	Slipring	440	360
250	Whse.	Sq. cage	2200/440	1200
250	G.E.	Sq. cage	440	600
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225	E.M.	Synch.	440	1800
225	G.E.	Synch.	2300	900
225	G.E.	Synch.	220/440	600
200	Al. Ch.	Synch.	440	360
200	G.E.	Slipring	220/440	360
200	F.M. bb	Slipring	2300	900
200	Cr. Wh.	Slipring	220/440	600
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200	Rel. b.b.	Sq. cage	220/440	1200
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150	G.E.	Slipring	220/440	600
150	Rel. b.b.	Sq. Cage	220/440	1200
150	Al. Ch.	Slipring	2200/440	720
150	G.E.	Sq. cage	2200/440	720
150	G.E.	Slipring	220/440	450

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KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G.E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
500	El. Machy.		240/480	1200
500	Gen. Elec.	ATB	480	900
485	Allis Ch.	1 brg.	480	400
350	El. Machy.	1 phase	240/480	1200
312	Gen. Elec.	ATB	240/480	600
275	G.E. 25 cycle	ATI	480	750
250	Whse.	G	2400/480	600
225	Gen. Elec.	ATB	240/480	600
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
75	El. Machy.		2300	900

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KW	Mfr.	Input V	Output V
500	G.E. HCC conv.	2300 AC	275 DC
300	Allis Ch.	2200/440 AC	125/250 DC
300	Whse.*	2300 AC	600 DC
250	Allis Ch.	440 AC	350 DC
200	Whse.*	2300 AC	275 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.*	220/440 AC	125/250 DC
105	Century b.b.	220/440 AC	70 DC
100	G.E.	220/440 AC	125 DC
100	Delco b.b.	220/440 AC	125/250 DC
100	Allis Ch.*	220/440 AC	50 DC
75	Whse.*	220/440 AC	250 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Allis Ch. (2)	220/440 AC	125/250 DC
45	Gen. Elec.*	220/440 AC	60 DC
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35	C.W. b.b.	220/440 AC	125 DC
25	Whse.	220/440 AC	125 DC
25	Reliance b.b.	220/440 AC	250 DC
20	Whse.	220/440 AC	600 DC
21	Whse.	220/440 AC	35 DC
17	Gen. Elec.	220/440 AC	125 DC

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Whse.	SK	600	900
250	Allis Ch. b.b.	EW	250	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC38	250	675
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	C	250	750
100	Allis Ch.	E	125	1200
75	Whse.	SK	250	1150
60	Gen. Elec.	LC	250	700
50	Allis Ch. (2)	EW	125/250	1200
40	Gen. Elec.	RC	250	1150
25	G.E. b.b. New	CDM93	125	1500

D. C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Allis Ch. b.b.	EW	350	1000
300	Gen. Elec.	MPC	230	400
200	Reliance	1400T	230	850
150	Reliance	1050T	230	1200
150	Gen. Elec.	RC39	230	850
150	Gen. Elec.	MPC	230	500/1200
100	Cr. Wh. b.b.	JH	115	1150
100	Gen. Elec.	C	230	575/1000
60/75	Gen. Elec.	C	230	500/1200
60	Cont. b.b.	D107X	230	1150
50	Gen. Elec.	CD123	230	550/1200
50	Gen. Elec.	RC	230	1750
50	Al. Ch. (2)	E-131	230	1150

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1435 W. RANDOLPH ST. MO nroe 6-7409 CHICAGO 7, ILLINOIS

43rd YEAR —:— 43rd YEAR

MOTORS & GENERATORS, etc.

1 YEAR GUARANTEE

Partial Listing Only!

GENERATORS—250 V. D.C.

KW	Make	Type	Speed
500	G.E.	MPC	900
300 (2)	G.E.	CY-272	1200
300	Elliott		1200
250	Cr. Wh.	Syn.	1200
200	Delco		1200
150	West.	SK	900
125 (2)	G.E.	MPC	1200
100	West.	SK	1200
75 (2)	Cr. Wh.		1200
50	West.	SK	900
40	West.	SK	1150
40	ABSee	5VG3	1150
30	G.E.	TC93-4	1800
25	G.E.	RC	1150
20	Watton	D	1150
15	Star		1750
10	G.E.	RC	1150
7½	West.	SK	1750

GENERATORS—125 V. D.C.

KW	Make	Type	Speed
150 (2)	West.	SK	1200
100	El. Mchy.	651-T	1200
100	G.E.	RC	1200
100 (2)	West.	SK	900
100	G.E.	MPC	900
75	G.E.	DLC	1150
60 (2)	West.	SK	1800
50	G.E.	RC	1150
50	Cr. Wh.	CCD	1160

LOW VOLTAGE D.C.

Amp.	Make	Voltage
10000	J-L	2/10
7500 (2)	Nor.	7½
5000	HVW	6
2500	Chandey.	6/12
500	Chandey.	12
1500	Century	24
500	West.	32
1000	Century	32
1000	Chandey.	40
1500	Century	40
1500	G.E.	50
1000	G.E.	60
1000	G.E.	75

JUST PURCHASED

350—230v. D.C. Motors

Over 6200 Total H.P.

G.E.—WEST.—RELIANCE, etc.

Speeds 500 to 1750 RPM

2—150 HP	6—40 HP	75—10 HP
1—125 HP	2—30 HP	78— 7½ HP
12—100 HP	1—25 HP	21— 3 HP
16— 75 HP	29—20 HP	22— 2 HP
2— 60 HP	55—15 HP	31— 1 & 1½ HP

MOTORS—Squirrel Cage

H.P.	Make	Type	Speed
250	G.E.	KT550	1750
200	Wagner	RP-2	1800
200	G.E.	KF	880
200 (2)	Al. Ch.	AR	870
200	G.E.	K6	700
150	Wagner	21VRN	900
150	West.	CS	600
125	Al. Ch. (5)	AR	1760
125	G.E.	IK	1150
100	G.E.	KT	1800
100	G.E.	IK	1750
100	West.	CS	1750
100 (2)	Al. Ch.	AM	1150
100	G.E.	K	1175
100	West.		870
75 (2)	West.	CS	1750
75	G.E.	KT	900
75	West.	CS	720

MOTORS—Slip Ring

H.P.	Make	Type	Speed
500	Elliott		1150
500 (2)	G.E.	IM	450
400	G.E.	IM	900
400	West.	CW	435
250	G.E.	IM	435
200 (2)	G.E.	IM	1170
200	G.E.	MT	1175
125	West.	CW	1750
100	G.E.	MT	1150
75	Lincoln		1750
75	G.E.	MT	900
75	West.	CW	690
60	G.E.	MT	1720
60	West.	CW	290

MOTORS—Synchronous

H.P.	Make	Speed
475	West.	720
300	G.E.	900
200 (2)	West.	900
200	Burke	900
180	G.E.	900
165	G.E.	1200
150	G.E.	900
150	G.E.	720
75	G.E.	900

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THE TRADE MARK WITH A MEANING SUCCESSFUL OPERATION GUARANTEED 44th YEAR OF SERVICE—MEMBER OF A.R.A.*

MOTOR GENERATOR SET

3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G.E.	514	600	13800/4000
2	2000*	G.E.	500	600	6800/11000
3	1500	G.E.	514	250	13200
1	1500	G.E.	720	600	6600/13200
1	1500	Whse.	600	600	2300/4600
1	1500	G.E.	360	275	2200/4400
1	1500	G.E.	600	600	2300/4150
2	1000	Whse.	900	600	2300/4150
1	1000	G.E.	900	260	6600
1	1000(3U)	G.E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	600	G.E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	900	250	6600/13200
1	500	Whse.	1200	125/250	2300
1	500	G.E.	720	125	2300/4000
1	400	G.E.	720	250	440/2300
1	400	Whse.	1200	250	2300
1	350	G.E.	900	125	2300/4150
1	300	A.C.	1200	125/250	2300
1	150	G.E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G.E.	1175	125	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	125	G.E.	1200	125	440
1	100	Delco	1200	125/250	440
1	75	G.E.	1200	125	4000
1	75	G.E.	1200	250	440
1	40	Whse.	1200	250	220

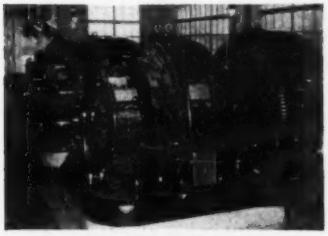
*25 Cycle

ROTARY CONVERTERS

1	2000	G.E.	514	600	13800
1	1000	Whse.	900	600	11000

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	6000	Al. Ch.	Condensing 200/250 ISP 2300/3/60 Exc. & Surface Cond.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P. 5/20# G. Ext. Surface Condenser—3/60/2300.
2	1000	G.E.	Non-condensing. 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
1	750	G.E.	Condensing 425#-725°TT ISP-440 V. 3 ph. 60 cy New—1944.
1	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
2	500	G.E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
1	400	Whse.	Non-condensing 125/150# ISP 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 10/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy.



3—1500 KW—250 V. D.C.—13200 V. A.C.
NOW AVAILABLE.

D.C. MOTORS

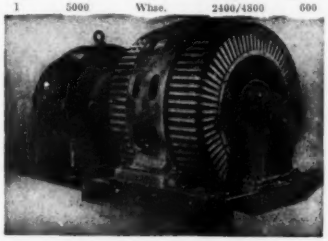
Qu.	HP	Make	Type	Volts	Speed
1—	2200	G.E.	MCF	600	360/500
1—	1750	West.		600	525/720
1—	1500	Whse.		525	600
1—	940	Whse.	QM-R. Brg.	250	140/170
1—	800/1000	Whse.		450	600/720
1—	600	Al. Ch.	MILL	230	400/800
1—	500	Whse.	Mill	600	300/900
2—	450	Whse.		550	415
1—	400	G.E.	MCF	550	300/1050
1—	300/400	G.E.	DYNA	250	1325/2500
1—	350	Cr. Wh.	CCM-151H	230	1100
1—	335	Whse.	MQ	250	300/900
1	200/300	G.E.	MPC	230	360/920
1—	250	G.E.	MPC	230	400/500
1—	200	Rel.	1070T	230	720
1	150	G.E.		600	250/750
10—	150	Cr. Wh.	83H	230	800
1—	150	Cr. Wh.	CMC-65H	230	1150
1—	150	Whse.	SK-201	230	360/950
2—	150	Whse.	SK-151 B	230	900/1800
1—	50/120	G.E.	MPC	230	256/1000
2—	100	Whse.	SK-181	230	450/1000
2—	80	El. Dy.	308	230	475/1350
1—	60	El. Dy.	258L	230	750/1500

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1—	3000	G.E.	25/60	4000/2300x2300/4000
1—	2000	G.E.	25/62½	2300/4160
1—	2000	Whse.	25/62½	2300/2300
1—	1000	G.E.	25/58	4400/2300
1—	500	A.C.	25/60	11000/2300V

SYNCHRONOUS CONDENSERS

Qu.	Kva	Make	Volts	Speed
1	5000	Whse.	2400/4800	600

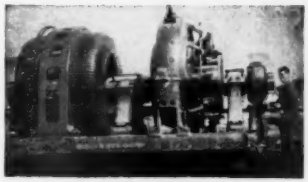


500 KW MG SET
IN STOCK

TRANSFORMERS

60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
1	3000	Whse.	Furnace	3	26400/13200x190
3	2000	G.E.	HVDDJ	1	66000x13800
3	1000	G.E.	H	1	2200x480
9	1250	G.E.	H	1	6600x550
1	1150	A.C.	OISC	3	13200x2300/180
1	500	Whse.	OISC	3	13400x216
9	300	G.E.	HT	3	2400x240/480
3	150	Whse.	OISC	1	33000x2300/4000
3	100	G.E.	OISC	1	2400x120/240
2	75	Upte	OISC	3	4160x240
1	50	Mol.	Askerel	3	13200x120/208
3	10	G.E.	H	1	2300x115/230
9	7½	G.E.	H	1	2300x115/230
3	5	Mol.	HE	1	113800x115/230



2000 KW—MG SET
IN STOCK

A. C. MOTORS

3 ph. 60 Cycle
SYNCHRONOUS

HP	Make	Type	Volts	Speed
1—4350	Cr. Wh.		4160/13800	514
2—3500	G.E.	TS	2300	257
1—2500	Whse.		2500	720
3—2100	G.E.	ATI	2300	360
2—2000	Whse		2300	120
3—1750	G.E.	ATI	2300	3600
3— 735	G.E.	ATI	2200/12000	600
1— 500	G.E.	TS 7657	2400/4800	600
1— 450	Whse	Eng.	2200	128.5
1— 450	Whse.		2300	450
2— 350	G.E.	TS	2200	150
1— 300	Whse.		2300	720
1— 150	Whse.		440	600
1— 100	Whse.		550	600
1— 100	F.M.		220	1200
1— 100	E.M.		440	600

SLIP RING

1—1500	ABB		2300	720
1— 500	Whse.	CW	350	350
2— 500	G.E. unused	M-574Y	2200	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM	440	900
1— 400	Whse.	CW	440	514
1— 350	G.E.	MT442-Y	2200/4000	253
4— 300	G.E.	ITC-5017	550	585
1— 300	Al. Chal.	ANY	2200	708
1— 300	A.C.		440	514
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-5598	2200	1750
1— 250	A.C.		550	600
1— 200	Cr. Wh.	26QB	440	505
1— 200	G.E.	IM	440	455
1— 200	G.E.	MTP	440	1170
3— 200	G.E.	IM-17	440	580
1— 200	Whse.	CW	440	490
1— 200	G.E.	IM	440	600
1— 150 new	Whse.	CW	2300	450
1— 125	A.C.		440	720
4— 125	G.E.	MT-506Y	440/2200	435
1— 100	G.E.	IM-16	2200	435
1— 100	G.E.	IM	440	600
3— 100	Al. Ch.	ANY	440	695
1— 100	G.E.	MT556	2200	900
1— 75	Whse.	CW-761	2200	1725

SQUIRREL CAGE

2— 650	G.E.	FT559BY	440	3750
2— 450	Whse.	CS	2300/4150	354
1— 300	G.E.	KT-574Y	2300	505
1— 200	G.E.	IK-17	100	580
1— 200	G.E.	KT557	440	1800
1— 200	G.E.	IK	440	865
1— 150	Whse.	CS	440	580
1— 150	Wstghse.	CS8568	440	830
1— 125	Whse.	MS	440	485
1— 125	G.E.	KF-TEFC	440	3585
2— 125	Al. Ch.	ARW	2200	1750
1— 100	G.E.	IK-Vert.	2300	456
1— 100	G.E.	KT-513	2200/440	1750
3— 100	G.E.	IK	440	580

*American Rebuilders Association — Member Body of A.S.A.

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Electrical Equipment ~ Rebuilt and Guaranteed ~ Motors ~ Generators ~ M-G Sets ~ Transformers ~ Controls

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PROMPT SHIPMENT — PARTIAL LISTING

250 VOLT DYNAMOMETERS

Cradle Type With Scale and Control

Write for Complete Specifications

Qu.	Make	HP	RPM	Type
1	G.E.	150	2200/5000	TLC-50
1	West.	150	2200/5000	SK-131
1	G.E.	200	1200	C

SLIP RING MOTORS—3 Ph., 60 Cy.

Qu.	HP	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-520
2	10	1140	440	West.	HF-7A
2	10	570	220	G.E.	HI-11
2	11‡	820	550	G.E.	ITC-5008
1	15	570	220	West.	CW-646
1	18	680	440	West.	MW-316
1	20	860	440	West.	CW-638
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	BR
2	25	720	440	Wagner	22VBR
1	30	865	440	West.	CW-646
1	30	850	440	L.A.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	400	F-M	HV-H16A
1	40	865	2200	Al. Ch.	ARV-223C
1	40	560	440	G.E.	MT-346
1	50	1150	440	G.E.	MT-536
1	50	570	440	G.E.	MT-552
1	60	685	440	West.	CW-758
1	60	570	550	G.E.	MTC-5546,
1	60	345	550	West.	CW-938
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	865	550	West.	CW-1002
1	200	495	2200	G.E.	IM-17A
1	250	600	2300†	G.E.	IM-17
3	300	900	440	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-E15A
1	400	505	550	West.	CW
1	600	1770	440*	G.E.	IM-E15C
1	700	735	4000‡‡	West.	CW

220 volt meters can be reconnected for 440 volts.
‡Intermittent rating. ‡‡25 cycle.
**New. †Also 440 or 550 volts.
*Also 2300 volts.

A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding. Direct Connected Exciter.

Qu.	KVA	RPM	Make	Volts
2	18.7	1800	Columbia	240/120
4	18.7	1800	Columbia	208/120

230 VOLT CONST. SPEED D.C. MOTORS

Qu.	HP.	Speed	Make	Type
10	3	850	Reliance	T-23T
6	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
2	7½	850	G.E.	CD-75
10	10**	1750	Kimble	BA-324
5	10**	1150	Al. Ch.	ED-80
2	10	850	West.	SK-88
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
1	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20**	1450	G.E.	CDM-83
1	20	1750/1310	West.	SK-83
2	20	1150	G.E.	RC-59
1	20**	1450	G.E.	CDM-83
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
2	200	1150	G.E.	RC-36
1	250	1150	C.W.	CMC-101

230 VOLT ADJ. SPEED D.C. MOTORS

Qu.	HP.	Speed	Make	Type
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
1	12½	280/840	West.	SK-130
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	300/1200	West	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	25/29	300/1200	G.E.	RF-13
1	30/40**	400/1600	G.E.	CD-1256
1	35	500/1500	West.	SK-143
1	40/50	400/1200	West.	SK-163
1	75	375/750	Cr. Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al. Ch.	
1	100	320/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/500	West.	SK-220
2	375	350/500	G.E.	MPC

**New

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.

Totally Enclosed Fan Cooled, Ball Bearing

Qu.	HP	RPM	Volts	Make	Type
4	2	1140	220	L.A.	JS-225Y
3	3	1160	440	L.A.	JS-254
4	5	1730	440	G.E.	K-254
2	7.5	1740	440	G.E.	K-284
1	10	1735	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JA-405
1	25	705	440	West.	CS-W504

SPLASHPROOF, BALL BEARING

Qu.	HP	RPM	Volts	Make	Type
1	3	1160	440	L.A.	FS-254
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
4	15	1150	440	L.A.	FX-365
1	50	1760	440	L.A.	FX-445A
4	50	1150	220	G.E.	K-504
1	150	1775	440	L.A.	FX-1168
2	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335

OPEN TYPE MOTORS

Qu.	HP	Speed	Volts	Make	Type
3	10	3500	440	G.E.	KT-56
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	900	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RPI-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KT-512
2	20	1160	440	West.	CS-464C
2	20	900	220	G.E.	FTR-522
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRB-356***
1	25**	875	440	Master	PB-405
2	25	575	550	G.E.	K T-542
3	30	3550	550	G.E.	K-3648
1	30	1755	220	G.E.	FT-513
1	30	1160	440	West.	CS-644
1	30	870	220	West.	CS-646
1	40**	3545	220	G.E.	KF-4048
4	40	1750	440	West.	CS-583C
2	40	900	2200	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
2	60*	1750	440	Howell	AH-444
2	60	980	440	G.E.	KT-546
2	75	1775	440	West.	CS-505
2	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-352B
2	100	600	2200	West.	CS-930
1	100	495	2200	Al.Ch.	AN
8	125	1750	2200	Al.-Ch.	AR
1	125	435	440	Al.Ch.	AR
1	125	400	2300	G.E.	I-17-FR
2	200	580	550‡‡	G.E.	KT-5668
2	300	587	2200	West.	CS-39A
1	500	1200	140	G.E.	KTP-567
1	700	1800	2300/ 4000	West.	CS-4-39D12

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts.

50 KW M-G SET

Three bearing, 50 KW, 250 Volt, 1200 RPM, Compound Wound, Type SK-153, Westinghouse D.C. Generator driven by 75 HP, 1.0 PF, 1200 RPM, 2200 Volt, 3 Phase, 60 cycle Westinghouse Synchronous Motor. With Control. Write for Complete Information.

100 KW M-G SET

Three bearing, 100 KW, 125/250 Volt, 1160 RPM, Type SK-163L Westinghouse D.C Generator driven by 145 HP, 1160 RPM, 2300/4100 Volts, 3 phase, 60 cycle, Type CS-873C Westinghouse Induction Motor. With Control. Write for Complete Information.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention All Equipment Is Located In Our Cleveland Warehouse We have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVENUE • CLEVELAND 14, OHIO

TRANSFORMERS

60 Cy. Single and 3 Phase

KVA	Make	Pri. Volts	Sec. Volts
6000(1)	Am. Br. Bov.	2400	5040/4800Y
3750(1)	Uptegraff	22000	600
3750(1)	Uptegraff	22000	440
3000(1)	Uptegraff	22000	440
3000(1)	GE	22000	480
3000(1)	Uptegraff	22000	550
2500(3)	West.	27600	2300
1250(3)	GE	33000/11000	2200
1000	West.	2200	220
833(2)	GE	13800	460
833(3)	West.	2300	575
800(3)	GE	22000	2300
750(4)	GE	2200	244/488
667(3)	GE	13200	2300/4000
667(1)	Al. Ch.	13200	480
500(2)	GE	11000	2300
500		4600	460
500(6)	GE	33000	6600/2300
500(6)	GE	6640/11500Y	75/120
450	Uptegraff	11000	460
450(1)	Uptegraff	11000	230
400(3)	GE	2200	244/488
333(1)	GE	22000	2200
333(3)	GE	22000	2200
333(1)	GE	22000	2300
333(2)	GE	11500	115/230
333(3)	GE	11000	2200
333(3)	West.	2400	120/240
300(3)	West.	14520	550/230
300(1)	Pitts.	6600	110
300(3)	Pitts.	2300	115/230
300(2)	GE	2300	115/230/440
250(1)	GE	2400	240/480
250(3)	Mol.	34500	2300
250(3)	GE	2400	240/480
250(1)	Wag.	2300	440
250	West.	468	
200(3)	West.	26400	267
200(4)	West.	13800	278
200(3)	West.	13200	2300
200(3)	Al. Ch.	33000	220/440
200(3)	L.M.	7200	120/240
200(2)	Pitts.	12000	115/230
200(3)	Wag.	2300	230/115
200(3)	GE	2400	120/240
200	GE	495	120/240
200	GE	2200	122/244
200	West.	2300	600
200	GE	11500	460
200	West.	3984	115/230
200	GE	6900	2400
150(1)	West.	6900	120/208
150(3)	West.	14400	600
150(3)	West.	14400	575/230
150(4)	GE	12000	115/230
150(1)	West.	2400	480
150(4)	Packard	4600	230/115
150	GE	2400	240/480
150(3)	GE	2200	110/220
150(3)	Pitts.	7200	115/230
150(3)	GE	4150	120/240
100(4)	Penn.	600	120/240
100(3)	GE	14400	2400/4800
100(2)	Al. Ch.	4600	230/115
100(2)	West.	13200	220
100(4)	Al. Ch.	2400	480
100(2)	Pitts.	2300	230/460
100(1)	West.	2300	230/115
100(4)	Al. Ch.	2300	230/115
100(1)	GE	2300	230/460
100(7)	GE	1980	220/440
100(3)	GE	1100	220/440
100(3)	Pitts	4600	230/115
100(3)	GE	460	115/230
100	GE	11500	230/460
100	GE	11000	2300
100	GE	2400	120/240

WE STOCK 1200 UNITS 5 TO 75 KVA.

MOTORS • GENERATORS TRANSFORMERS

25 cy. 60 cy. D.C.

ALL VOLTAGES 1-1500 H.P.

NEW and REBUILT BOUGHT and SOLD

ELECTRIC EQUIPMENT CO.

ROCHESTER 1, N. Y.

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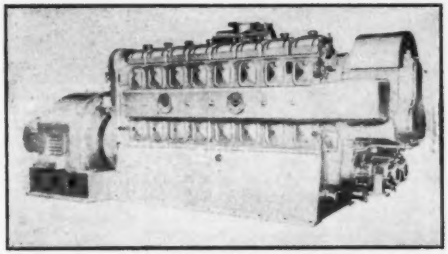
KNOW THE INTEGRITY OF YOUR SUPPLIER AND YOU WILL KNOW THE QUALITY OF YOUR MACHINERY

Integrity

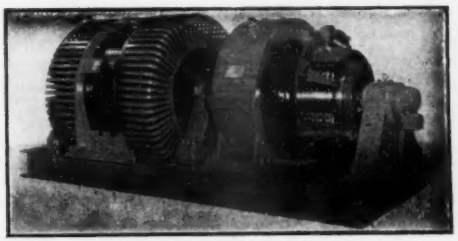
For over 37 years, The O'Brien Machinery Company has faithfully upheld the highest standards of business practice while serving our country's industry.

Quality

The O'Brien Machinery Company employs modern techniques, experienced craftsmen and the latest shop equipment to provide you with top quality, new, rebuilt and reconditioned machinery.



375 KVA GM DIESEL GENERATOR SET



500 KW WEST. MOTOR GENERATOR SET

MOTOR GENERATOR SETS

1—1500 KW GE MPC 300 V 5000 Amp.—2150 HP ATI-Syn Motor, 3/60/4000 Volt. Available immediately.
1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels.
1—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/6600/13200 volt, Serial #813047 (year 1935) See actual photo above.
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/6/2300 V. A.C. & D.C. Panels.
1—400 KW West. 500 Volt D.C. Any A.C. Voltage with 500 HP West. 350 RPM, 500 Volt Motor for complete drive.
1—350 KW GE CY 125, 180 V., Sep. Exc., 1200 RPM, 500 HP Syn. Mtr., 3/60/2300, 1942.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
1—150 KW West., 125/250 V., 1200 RPM, 250 HP Syn., 3/60/440, New 1936.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.
1—100 KW Al. Ch., 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V., 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/440/1200 RPM.
Smaller Sizes and Types—Advise Requirements

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	4000	GE	33000	13200	1
3	1000	GE	13200	2300	1
3	1000	West.	33000	2300	1
1	1000	Penna.	13200	480	1
1	1100	West.	4400	440	3
3	833	GE	13800	460	1
3	750	West.	2300	230	1
3	500	GE	13200	2300	1
3	333	GE	2400	480	1
3	333	GE	13200	2300	1
3	250	West.	13200	2300	1
3	200	GE	7200	120/240	1
3	200	GE	13200	2300	1
3	200	Mal.	2300	220/440	1
3	200	GE	13200	2300	1
3	200	GE	7200	2300	1
3	150	GE	33000	220/440	1
3	150	Ning.	2400	240/480	1
3	100	West.	11000	480	1
3	100	GE	7200	120/240	1
2	100	GE	2300	115/230	1
3	75	Mal.	2300	115/230	1
3	50	GE	13200	120/240	1
3	50	GE	13200	2300	1
4	37½	West.	2400	240/480	1
3	25	West.	2300	115/230	1
3	25	West.	6900	2300	1
2	15	GE	2400	120/240	1
3	10	GE	220	110	1
10	1½	GE	2400	120/240	1

DIESEL & GASOLINE GENERATOR SETS

6—875 KVA G.E.—Busch Sultzer 3/60/2300/275 RPM, Complete Plant, 1940
1—580 KVA F.M. 3/60/2300/300 RPM
5—475 KVA Cooper Bessemer 400 RPM 3/60/2300, Complete Plant, New 1940
2—438 K.V.A. GM—West. 3/60/2200 360 RPM —New 1937. Complete Plant.
1—375 K.V.A. GM 8-268A, 3/60/480/1200 RPM
1—300 K.W. GM New 8-268A, 230 DC.
1—187 KVA G.M. Twin 6-71 Portable, 3/60/220/440 New
1—125 K.V.A. Hercules. 3/60/220/440/1500 Hrs
1—56 K.V.A. Climax Gasoline. 3/60/220/1200.
2—45 K.V.A. Chry. New 6 Cyl. 3/60/220/440.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	West.	CW	2300	450
1	600	West.	CS	2200	600
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600	514
2	400	G.E.	IK	2300	1800
1	400	West.	TEFC	440	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	315	G.E.	Syn.	2200	720
1	200	West.	Syn.	2300	1200
1	150	Ideal	Syn.	220	1200
1	125	West.	Syn. (S brg.)	550	600
2	100	G.E.	Syn.	440	900
1	75	West.	CW	440	1200
1	50	West.	CS	440	3600

TURBO GENERATORS

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 psi 50 lb. B.P.
1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 25 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440. 150 PSI 10 lb. B.P.
1—375 KVA West. Non-Cond. 3/60/440, 125 PSI 5 B.P. New 1938.
1—187 KVA West. Non-Cond. New 1939 3/60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

AIR COMPRESSORS

1—12,000 CFM I.R. Turbo 3.25 lb., direct 250 H.P., 440/3/60/3600.
1—5600 CFM I.R. PRE-2, 42/25½x30, 100 lb. direct 930 HP Syn. 1 P.F. 2300/60/3.
1—4690 CFM I.R. PRE-2 48/24x27 100 lb. direct 804 HP Syn. .8 PF 2300/60/3.
1—3000 CFM GE Turbo 5 lb. direct 90 HP 440/3/60/3600.
2—1400 CFM Sullivan WJ 3 Angle Cpd. 100 psi 22/13x16 belt.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—734 CFM Sullivan W-13 13/13x8 60 lb. belt.
1—528 CFM CP NSB 14x12 100 lb.
1—371 CFM Schramm 7½/5x4 100 lb.
1—368 CFM I.R. ER-1 12x100 100 psi.
1—396 CFM Sullivan type WL-60 100 psi.
1—215 CFM Penna. 3A 10x8 50 lb.
1—173 CFM CP NSB 9x8 100 lb.
1—173 CFM Penna. 3A 9x8 100 lb.
1—122 CFM Worthington 7x7 Horiz. 100 lb.
1—89 CFM CP 6x7 TB 150 lb.
1—40 CFM I.R. Type 30 80 lb. Tank mtd. 7½ HP
3—21 CFM Curtis CJ-1000, 3 stage 850 lb.
5—16.86 I.R. Type 30, 3½/2x5 400 lb.
100—10 CFM I.R. Type N 26 lb. or 25" Hg. Vac.

"Everything from a Pulley to a Powerhouse"

SINCE 1913

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LEADING MACHINERY DEALERS & EXPORTERS

1547 N. DELAWARE AVE., PHILADELPHIA 25, PA.

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There's more than 40% to 60% SAVINGS on

SCHOONMAKER DEPENDABLE DIESEL POWER

because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

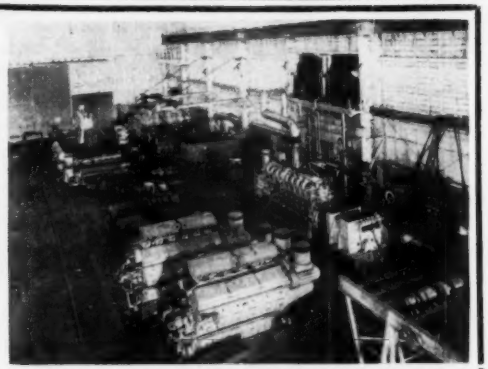
Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

A.G. SCHOONMAKER CO., INC.

52 CHURCH ST., NEW YORK 7, N. Y.

PLANTS AND WAREHOUSES:
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1500	Fairbanks Morse	33E16	2000	300
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	General Motors	8-567	720	720
350	Baldwin	VO-6	510	450
320	Buckeye	80	480	600
320	Enterprise	DSG-6	460	450
250	Fairbanks Morse	33-D	375	360
300	General Motors	8-268A	450	1200
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200
30	Inter. Harvester	UD-14	45	1200
15	Inter. Harvester	UD-6	23	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

Immediate Delivery in All Types of

BOILERS

Bought • Sold • Rented

We own and offer the following types of equipment now located at our warehouse:

1—50 H.P., 150 lb. Clayton Package Boiler
Erie City Economics—125, 170, and 200 H.P.
Fire Box Boilers—165 H.P.
Package Type Boilers—18, 30, and 100 H.P.
2 New Frederick Stokers—2500 lbs. of coal/hr.

BOILER & EQUIPMENT CO.
743 Bedford Ave. Brooklyn 5, N. Y.
ULster 5-3588

SPECIAL TRANSFORMERS — YOUR SPECIFICATIONS

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OIL COOLED
AIR COOLED
PHASE CHANGES

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0433

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

DIESEL, NAT. GAS OR GASOLINE ENGINES

15—400 HP General Motors 8 cyl. 8x10, 900 RPM equipped for nat gas, butane or gasoline, weight only 12,000 lbs.
2—360 HP, 1—240 HP F&M Mod 32 w/ generators
2—180 HP, F&M, 3SE, 8½x10, 475 RPM
2—120 HP Atlas, 6 cylinder, 550 RPM
1—200 HP Buda Diesel Power Unit, 900 RPM
1—100 HP, A-100 International, 1800 RPM
All above reconditioned & offered at bargain prices, or will rent. We offer other engines, generators; electric motors; pumps; compressors; switchgear & electrical apparatus. 5000 stock items, each a bargain.

GENERAL MACHINERY & EQUIPMENT CO., INC.
809 Woodland Kansas City 6, Mo.
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BOILERS

10 to 5000 H.P.
Diesel, Steam Turbine, Engine

GENERATORS

Heavy Power Equipment
Industrial — Chemical Process Equipment

NEW – RECONDITIONED – USED

DEAN G. STRICKLER & ASSOCIATES
1346 Connecticut Avenue, N.W.
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SEPTEMBER, 1952

CHICAGO Electric Digest

PUBLISHED BY CHICAGO ELECTRIC CO. • THE HOME OF GUARANTEED REBUILT POWER EQUIPMENT

GUARANTEED REBUILT EQUIPMENT AID TO INDUSTRY

SQUIRREL CAGE

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	Speed
1000	*G.E.	K6347S	1800
750	*G.E.	KT	720
750	*A.C.	TEFC	1800
700	G.E.	FT	2600
500	*A.C.	6316SW	1800
500	*G.E.	PGB	3600
450	*G.E.	KF567S	1200
400	*Continental	NZ	1200
400	A.C.	ANW	900
400	*G.E.	IK	514
350	*Cr.-Wh.	SC	3600
300	*Westgh.	CS	3600
300	G.E.	IE-K	1200
300	A.C.	AR	900
250	A.C.	630DSWW	1200
250	*L. Allis	OGX1488	720
250	G.E.	IK	600
200	*G.E.	FT549Y	3600
200	*G.E.	IK13B	1800
200	A.C.	ARWWT	600
200	G.E.	IK17	600
150	F.-Morse	H	900
150	G.E.	KT346	1800
150	*A.C.	AN	1800
150	G.E.	IE-K	1800
150	*G.E.	IK	600
125	*A.C.	AR226	1800
100	*G.E.	FT542Z	1800
100	G.E.	FTRP	1800
100	*Westgh.	CS	1800
100	A.C.	AW	1200
100	G.E.	IK13A	1200
100	U.S.	CFU (Vert)	1200
100	*Westgh.	CS (Vert)	1200
100	A.C.	AN	900
100	G.E.	IK15A	514
75	A.C.	AN	1800
75	Westgh.	CS645C	1800
75	G.E.	KT346	1200
75	Westgh.	CS	900
75	A.C.	AR (Vert)	900
75	G.E.	IK	600
75	Triumph	TR16	514
75	G.E.	IK	514
60	*Westgh.	CS504S	1800
60	A.C.	APZ445S	1800
60	A.C.	APZ504U	1200
60	Armor	AB51	1200
60	A.C.	AR823	900
60	A.C.	AR826F	514

Hundreds of Smaller Motors!!

D. C. MOTORS

Mill Type—Pedestal Bearing—Reversing

HP	Make	Volts	Speed
3000	West. (Tandem)	525	600
1750	West.	600	550
1500	West.	525	600
1200	West.	525	600
1000	West.	450	600

230 Volts—Constant Speed

H.P.	Make	Type	Speed
375	Westgh.	Ped	650
200	Westgh.	SK210	800
175	G. E.	ELC	750
125	G. E.	Marine	1200
100	G. E.	RC34	2500
100	A. C.	E182	575
100	G.E.	ELC	750
75	G.E.	MDS106	485
50	G.E.	RC35	700
40	Cr.-Wh.	CMC	1750
40	G. E.	CO2004	600
35	Cr.-Wh.	CM351	700
30	Westgh.	SK93	1750
30	Westgh.	SK120	975
30	Cr.-Wh.	CCM	440
25	G. E.	CD93	1200
25	Westgh.	SK100L	1100

MANY OTHERS—1 HP and Up! Also 115 Volt

CRAFTSMANSHIP MEANS QUALITY

SLIP RING

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	Speed
2500	*G.E.	MT	257
500	Westgh.	CW	350
400	A.C.	3 Brg.	450
400	*G.E.	MT-412	450
300	*G.E.	IM-15	1800
300	*G.E.	MT-410	450
250	Westgh.	HF15H	600
200	G.E.	IM	1800
150	Westgh.	CW772C	1200
150	*G.E.	IM-16	600
125	*G.E.	MT-349	1800
125	G.E.	IM17A	600
100	A.C.	ANY	900
100	G.E.	IM	450
75	G.E.	MT547	1200
75	G.E.	MT356	900
75	G.E.	IM	720
60	Westgh.	CW762C	900
50	G.E.	IM11A	1800
50	A.C.	ARY	1800
50	Westgh.	CW636A	1200
50	G.E.	MT346	720
50	G.E.	IM	600
50	G.E.	IM14	450
40	G.E.	MT336	1200
40	Westgh.	CW644C	900
35	G.E.	IM	1200
30	G.E.	MT532	900

Hundreds of Smaller Motors

HI-PRESSURE

PUMPS

GPM	Make	Type	Head
800	Worth	6DS	925 ft.
500	Manistee	H	250 ft.
300	Al.-Ch.	NMZ	800 ft.

AC SYNCHRONOUS

MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

H.P.	Make	Type	R.F.	Speed
1420	*Westgh.		0.7	900
800	G. E.	TS984	1.0	1800
700	G.E.	TS975Z	1.0	514
320	*A. C.		1.0	720
300	G. E.	ATI	0.8	900
300	*G. E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
250	*A. C.		0.8	720
150	*Westgh.	HR	1.0	300
125	Parkinson			900
125	*El. Ma.		1.0	900
125	Cr.-Wh.	103S	1.0	900
125	*G. E.	TS	1.0	277
115	El. Ma.	KM	1.0	240
100	Cr.-Wh.	103S	0.8	900
100	*G.E.	ATB	0.8	900
100	Ideal	SNS	1.0	900
75	G.E.	ATI	1.0	900
40	G.E.	ATB	0.8	1200
20	Fynn-W.	15 VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800

AC SYNCHRONOUS

GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

KVA	Make	Type	P.F.	Speed
3500	*G. E.		0.8	720
1750	*Westgh.		0.7	900
1500	G. E.	ATI	0.8	720
250	*A. C.		0.8	720
112½	*G. E.	ATB	0.8	1200
110	Cr.-Wh.	103	0.8	900
100	*G. E.	ATB	0.8	900
60	F-M	B	0.8	900
55	G. E.	ATB	0.8	1200
50	G.E.	ATB	0.8	1200

PHONE: CANAL 6-2900

CHICAGO Electric Co.

1320 West Cermak Road, Chicago 8, Ill.

CHICAGO ELECTRIC EXPERTS DO OUTSTANDING JOB

For over 42 years, Chicago Electric has been a leader in the rebuilding of electrical power equipment. This record of business is positive testimony to the exacting standards and high quality of the Chicago Electric rebuilding work. Equipment is rebuilt to perform "like new" and fully guaranteed. Whatever your needs be sure to check with Chicago Electric first.

A COMPLETE SERVICE

Chicago Electric offers a complete service to industry that covers, REWINDING, REPAIRING, REBUILDING, REDESIGNING, COILMAKING, SPECIAL MACHINING, POWER SURVEYS POWER-FACTOR CORRECTION and RENTAL of equipment.

M. G. SETS

K.W.	Make	A.C.	D.C.
2400	A-C (3-unit)	4800	525
2400	West. (3-unit)	4800	600
1000	G. E. (3-unit)	11000	137½/275
1000	West. (3-unit)	11000	137½/275
500	Al. Ch.	2300	250
500	Cr.-Wh.	220/440	250
450	G. E. (3 unit)	2300	125/250
250	West.-G. E.	440	250
200	Ridgeway	2200	250
150	G. E.	2300/440	250
150	G. E.	440	275
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	G. E. Delco	440	120/240
75	Al. Ch.	440	250
60	Al. Ch.	2300	110
40	A. C.	220	125
40	Cr.-Wh.	220	125
35	G. E.	440	125
25	Westgh.	2300	125
20	G. E.	440	125
20	G.E.-Bogue	440/550	250
20	G. E.	220/440	250
20	G.E.-Bogue-	220/440	125

DC to AC, 3 Phase, 60 Cycle

KVA	Make	DC	AC
100	G.E.	235	230
75	Westgh	110	2300
12½	Westgh	115	240

ENGINE-GENERATOR SETS

KVA	Make	Type	Volts	RPM
300	Gen. Mot.	8-268A	480	1200
100	Gen. Mot.	3-168A	480	1200
100	Gen. Mot.	6-71RC	480	1200
31	Cummins	HI-6	120/208	1200
25	LeRoi	20-A	120	900
1½	Kohler	D-7551	110 DC	1000

TRANSFORMERS

KVA	Make	Ph.	Pri.	Secondary
1000	Westgh.	3	4800	480
850	Westgh.	3	4160	416
450	G.E.	3	2300/4000	230/460
300	G.E.	3	13800	240/480
300	G.E.	3	2400	240/480
200	Wagner	1	2400	575
167	A.C.	1	2400	120/240
100	Pitts.	1	2400	575
100	A.C.	1	2400	120/240
50	Sorgel	1	2400	120/240

SPECIAL

110 NEW Hi-Torque—Hi-Slip Motors 3/60/220/440, BB. Staright Shaft 1 — 1½ — 2 — 3 — 5 — 7½ HP. Speeds —1020 to 1135 RPM. OPEN and TENV.
Less than HALF of your usual Cost

MOTORS - M.G. SETS - CONTROL

NEW AND GUARANTEED REBUILT

M-G SETS

KW	D.C. Volts	A.C. Volts	Mfg.
500	125/250	2300	Whse.
400	125/250	2300	Whse.
300	250	2300	G.E.
150	250	440	Whse.
100	275	2300	Whse.
50	250	440	G.E.
40	250	220/440	G.E.
30	125/250	2300/4000	G.E.
7½VS	250	220/440	Rel.
3VS	250	220/440	Rel.

CRADLE TYPE DYNAMOMETERS

1—225 HP, Whse, 250 v. D.C. 300/2000 RPM, complete with Toledo automatic printing type scale.
1—150 HP, Whse., 275 v. D.C. 3000/5000 RPM, Frame 121, complete with all necessary control.

NEW MAGNETIC SLIP RING CONTROL

1—ALLIS 250 HP, 440 volt 125 HP, 220 volt) Reversing, 7 accel. steps, main line air ckt. brkr., fully magnetic, open or enclosed.

SLIP RING

HP	RPM	Volts	Mfg.
500	1200	220/440	Elliott (New)
400	300	2300	G.E.
350	450	2300	Whse.
200	450	2300	Burke
100	1160	440	G.E.
100	1800	440	G.E.
75	720	220	G.E.
50	720	220	Whse.

SYNCHRONOUS

HP	RPM	Volts	Mfg.	Type
600	1800	2300	G.E.	100%
400	900	2300	Whse.	80%
200	1800	440	West.	100%
150	200	440	G.E.	80%
150	600	440	G.E.	100%
150	720	2200	G.E.	80%
150	900	230	G.E.	100%

230 V. DIRECT CURRENT

HP	RPM	Mfg.	Brgs.
100	450/1350	Whse.	Sl.
50	400/1200	Rel.	Sl.
50	200/800	E-D	Ball
50	300/900	G.E.	Sl.
35	400/1200	Ideal	Sl.
30	250/1000	Whse.	S.Sl.
30	350/1050	Whse.	Sl.
30	500/1500	Rel.	Ball
25	300/1200	Rel.	Ball
20	250/1000	Whse.	Sl.
20	300/1200	Rel.	Ball

A.C. CONTROLS

1—700 HP, 4000-3-60. West. manual, red volt. starter.
1—500 HP, 4600-3-60, G.E. CR-1034, man. red volt. starter.
1—250 HP, 2300-3-60 G.E. CR-7006 magnetic starter, NEMA 1 encl.
1—150 HP, 2200-3-60 Roller Smith mag. red. volt. starter, auto-transformer type.
1—150 HP, Allen Bradley 220-3-60 magnetic, reduced voltage starter.
1—100 HP, 440-3-60 G.E. CR-7022Y1 wound rotor controller.
1—100 HP 2200-3-60 G.E. CR-7006Y1 magnetic, full volt. starter.
2—Size 5 G.E. magnetic starters, 220 or 440 v., NEMA 1 encl.
1—50 HP, EC&M automatic compensator, 440-3-60.
2—NEW C-H 25 HP, 440-3-60, magnetic, red volt. starter.
3—NEW C-H 15 HP, 440-3-60, magnetic, red volt. starter.

D. C. CONTROLS 230 volts

2—200 HP G.E. magnetic reversing, dynamic braking starters.
1—125 HP Clark magnetic adjustable speed starter.
1—New 100 HP Monitor magnetic, adj. speed starter.
1—Westinghouse 75 HP, reversing, dynamic braking starter.
1—New 75 HP C-H Bul 6130H92 plain magnetic starters.
1—50 HP Ward Leonard mag. adj. speed starter, dyn. braking.
2—40 HP G.E., magnetic, reversing, dynamic braking starters.
1—New G.E. 30 HP variable voltage controller CR 3270Y1, reversing, dynamic braking.
1—30 HP G.E. Planer Control CR 4630Y1, reversing, dyn. braking.
1—25 HP Westinghouse Class 8522 magnetic adj. speed starter.
(We can assemble any type D.C. control to your specifications)

Buy from BOSWICK with confidence

WAlbridge 1195

BOSWICK ELECTRIC CO.

P.O. BOX 55 — AKRON 9, OHIO

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Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

AVAILABLE—450 KVA, 3 phase, 60 cycle SUBSTATION 13200 to 115/230 volts including primary switchgear.
700 also 450 HP 180 rpm 4160 volt UNUSED syn. motor.
1875 KVA condensing turbine unit.
WANTED—1000 KVA 60 or 100 RPM 480 volt 3 phase 60 cycle coupled generator.

H. BLANE JOHNSON & ASSOC.
Application Engineers
53 W. Jackson Blvd. Chicago 4, Ill.

USED AUTOMATIC ELECTRIC PRECIPITATORS (Power Packs) 115 V. 60 cy. Single Phase Input —600 VA; Output—18 MA (4800-6000 Volts) Case Size 18"x14½"x24"—$50.00 each.

A A A STEEL, MCHRY, AND SUPPLY CO.
P. O. Box 6246, Dallas, Texas

REBUILT GUARANTEED POWER EQUIPMENT

MOTOR GENERATOR SETS

KW	MAKE	RPM	D.C.	A.C.
750	Al. Ch.	720	250	2300/440
600	West.	720	550	2300/4000
500 (2)	West.	1200	250	2300/4000
300	G.E.	1200	250	2300/4000
200	G.E.	1200	250	2300/4000
150	G.E.	900	550	2300/4000
150	G.E.	1200	250	2300/4000
100	G.E.	1200	250	2300/4000
35	G.E.	1800	125	220/440
15	Ideal	1800	125	220/440

ROTARY CONVERTERS

KW	MAKE	RPM	D.C.	Transformer
500	West.	1200	250	11450/9000
400	West.	1200	250/125	13800
200 (2)	Al. Ch.	1200	250	2300/4000
300	G.E.	600	250	2300/4000
200	G.E.	1200	250	2300/4000

Will rewind above transformers to your requirements

PLATING M-G SETS

6—1200/2000 Amp. 6/12 V.—A.C. Motors

A.C. MOTORS

HP	MAKE	RPM	TYPE	WDG.
450	G.E.	450	MT	S.R.
300	G.E.	450	IM	S.R.
200	G.E.	600	IM	S.R.
150	G.E.	600	ATI	Syn.
100	G.E.	450	IM	S.R.
100	West.	1200	CS	S.C.
100	West.	900		Syn.
100	G.E.	1750	IK	S.C.
60	West.	575	CW	S.R.
50	G.E.	1750	KT	S.C.
50	Al. Ch.	1200	AR	S.C.
50	G.E.	900	KT	S.C.
30	G.E.	900	KT	S.C.
30	G.E.	1200	KT	S.C.

TRANSFORMERS 1 PH. 60 CY.

KVA	MAKE	PRI.	SEC.
1—3000 (3 ph)	G.E.	23000	22000
2— 250	Al. Ch.	22000	2200
5— 100	West.	2400	240/480
5— 50	West.	2400	240/480
5— 25	West.	2400	110/220

D.C. MOTORS

HP	MAKE	TYPE	VOLTS	SPD.
300	Cr. Wh.	CCD	230	1100
300	West.	SK	230	300
220	West.	SK	230	175
150	G.E.	DLC	230	600
60	West.	SK105	230	435
50	West.	SK115	230	1750
50	Rel.	T185	230	1700
35	West.	SK95	230	1750
25	Rel.	T310	230	400/1800
20	Rel.	T282	230	400/1800
20	West.	SK83	500	1750
15/19	West.	KS	230	800/550
15	West.	SK113	230	825
10	West.	SK100L	230	400/1800
10	West.	SK80	230	750/1400
10	West.	SK80L	230	1150
9½/7½	West.	K3	230	880/685
5	West.	SK70	230	400/1800

AIR COMPRESSORS—HOISTS

142 CFM Ing. Rd. 100# pressure, belted 30 HP
386 CFM Chic. Pneu. 12"x10" 100# Pressure.
½ Ton—AC American
1 Ton (3)—DC Shepard
3 Ton—AC with motor trolley
4 Ton—DC Brown

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MOORHEAD ELECTRICAL MACHINERY COMPANY

(Power Specialists Since 19 9)

The BOSTON METALS Co. *offers* BOILERS, MILL MOTORS & TURBO-GENERATORS *at Bargain Prices*

2 MODERN PACKAGE TURBO-GENERATOR SETS

with self contained condensers

1350 K.V.A.—BUILT 1943

TURBINES: Westinghouse, Serial No. 2-A-9593-99 & 2A-9593-100. Impulse reaction type—7 stages condensing—3500 H.P.—4800 R.P.M. Steam pressure 440 P.S.I.—Exhaust pressure 27½" vacuum. Temp. 740°—weight 13000 lbs.

GENERATORS: Westinghouse, Serial No. 109S20P900 & 108S20P900—3 phase two pole type—2550 K.V.A.—82½ cycles—2210 volts—100% P.F.

THESE GENERATORS CAN BE RE-WOUND FOR APPROX. 1350 K.V.A.—3 PHASE—60 CYCLE 2300 OR 440 VOLT OPERATION WITH TURBINE SPEED REDUCED TO 3600 R.P.M.

CONDENSERS: Westinghouse—2 pass—2200 Sq. Ft.—vacuum 27½"—¾" tubes 12 ft. long—weight, 26,700 lbs. Condensers mounted below turbine. Oil Pump & oil cooler mounted directly on unit. Unit completely mounted on pre-fab sub-base.

THESE UNITS CAN BE DELIVERED RE-WOUND IN A VERY SHORT TIME.

6 B&W BOILERS

cross drum sectional header

BUILT 1943—IMMEDIATE DELIVERY

Heating Surface	11417 Sq. Ft.
Design Pressure	200 P.S.I.G.
Working Pressure	200 P.S.I.G.
Capacity	75,000 lbs./hour
Steam Temperature	Saturated
Furnace Volume	1024 Sq. Ft.
Feed Temperature	200°
Oil Burners	8 per boiler

BOILER DIMENSIONS

19' 4" wide, 16' 4½" high, 15' deep

BOILER TUBES

1667—1¼" straight, 12' 2" long
825—1¼" bent; 122—2" straight
(first 2 rows above fire box)
Downcomer & Uptake Tubes
4" & 4½" bent

WATER WALL SIDES IN FURNACE

HYDROSTATICALLY TESTED NOV. 1951 BY PRUDENTIAL LIFE INSURANCE CO.

3 MODERN TURBO-GENERATOR SETS

250 K.W.
440/3/60
1200 R.P.M.

TURBINES: Worthington-Moore, 440 lbs., W.P., 740° T.T., Serial No. 7454—7452—7432, type S4—5 stage condensing—28.5" Vac.—turbine speed 6097—gear speed 1200. Westinghouse-Moore reduct. gear 6097/1200.

GENERATORS: Westinghouse, 312 K.V.A.—250 K.W.—3/60/440 1200 r.p.m.—400 amps.—80% P.F.—125 volts d.c. excitation—exciters direct connected 5.5 K.W.

UNIT IS MOUNTED ON PRE-FAB SUB-BASE, BUILT-IN OIL COOLERS. THESE ARE MODERN UNITS RECENTLY REMOVED FROM A NAVAL VESSEL.

16 MILL MOTORS—*Complete With All Controls*

50 H.P.—230 VOLTS D.C.—600 R.P.M.

The BOSTON METALS Co.

313 E. Baltimore Street—Baltimore 2, Md.

Phone Curtis 5050

All items can be seen at the Boston Metals Co. Marine Warehouse, Curtis Bay, Baltimore

MOTORS • GENERATORS • TRANSFORMERS

7 x 7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 500 V. DC 750 RPM 800 Amps. Motor—580 H.P. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP 3/60/440/1800 Gen. Elect. Motor.

600 HP GEAR REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

T.E.F.C. MOTORS

60 HP Westinghouse CS-607 3/60/440/900 X-Proof

50 HP Ideal New. 3/60/220/440/1800

2—20 HP Louis Allis ES. 365 3/60/220/440/1800 X-Proof

15 HP Louis Allis EX-364 360/220/440/1800 X-Proof.

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheel 125 Volt DC 850 RPM Ball Bearing.

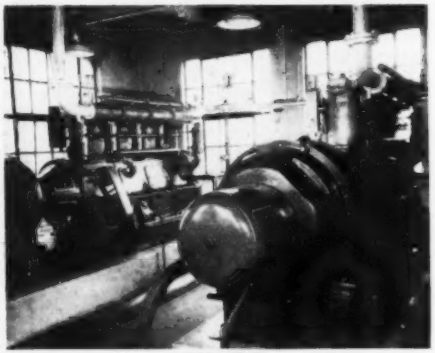
Will make 1200 RPM 125 Volt Generators.

REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy. 2400/4160 pri. 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y.
CL. 4758



GENERATORS

GENERAL ELECTRIC 62.5 KVA, 50 KW ALTERNATORS; .8 P.F. 127/220/3/60; 600 RPM; Model 13G741; Serial #6674476; 2 sleeve bearing and direct connected exciters.

Generators and engines mounted on welded steel one piece sub-bases.

IMMEDIATELY AVAILABLE

2—LIKE NEW 50 KW GAS OR GASOLINE POWER PLANTS, WITH MODERN METAL CLAD CONTROLS WITH ALL ACCESSORIES; USED LESS THAN SIX MONTHS; NEW 1947; STILL ON ORIGINAL FOUNDATIONS, AND UNDER REGULAR MAINTENANCE IN CLEAN HEATED BUILDING.

CLIMAX "BLUE STREAK" ENGINES. 130 HP, 600 RPM; 245 HP, 1200 RPM; 8 cylinder dual magneto ignition. Heat extraction, exchanger type cooling; rotary air cranking, (can be replaced with electric starters) Motor driven, Honan-Crane oil filters.

POWER PLANTS LOCATED IN CHICAGO

WILL SELL ENGINES SEPARATELY

CONTROL PANELS

MIDWEST UTILITIES POWER EQUIPMENT CORP.
1270 W. AUGUST BLVD. CHICAGO 22, ILLINOIS
ALL PHONES — EVERGLADE 4-4511
MEMBER N.I.S.A. & A.E.D. NORDBERG DISTRIBUTORS

FOR SALE

2500 KVA WESTINGHOUSE CONDENSING TURBINE GENERATOR UNIT

1—2500 KVA Westinghouse alternating current generator 3 phase, 60 cycle 2400/4160 volts 3600 RPM direct connected to Westinghouse condensing turbine, impulse re-action type, 250-400# steam pressure, 750° FTT, 3600 RPM.

Generator equipped with air cooler, direct connected exciter and switchboard panels with instruments. Turbine equipped with 2700 Sq. Ft. Foster Wheeler surface condenser, steam jet air ejector, inter-after condenser, motor driven circulating water pump, turbine driven circulating water pump, motor driven condensate pump, turbine driven condensate pump and meter panel with instruments.

New 1946 — Excellent Condition

* * * * * * *

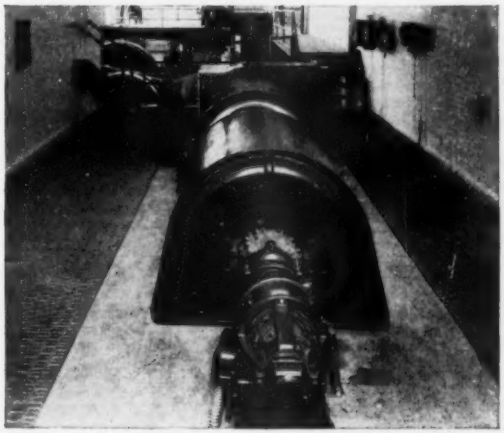
1563 KVA GENERAL ELECTRIC AUTOMATIC EXTRACTION CONDENSING TURBINE GENERATOR UNIT

1—1563 KVA General Electric alternating current generator, 3 phase 60 cycle 480/600/2400 volts 3600 RPM direct connected to General Electric automatic extraction condensing turbine, type F, form T, 9-stage, 175-400# steam pressure, 500-750° FTT, 0-30# extraction, 3600 RPM.

Generator equipped with air cooler, direct connected exciter and rheostats.

Turbine equipped with 2500 Sq. Ft. Worthington surface condenser with steam jet air ejector, inter-after condenser and two motor driven condensate pumps.

New 1936—Excellent Condition.



Write, Wire or Phone for Further Details and Prices.

INTERNATIONAL POWER MACHINERY CO.

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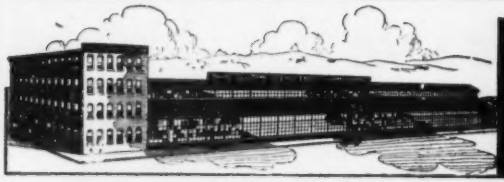

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PHONE MAIN 3024

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	900	440	G.E.
200	400	2200	G.E.-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	440	West.-CS
100	720	440	Westgh. 3 Brg.
85	3600	2300	G.E.
60	3600	2300	G.E.
60	1800	2200	G.E.
60	1200	440	Westgh. CS
50	1800	220	Triumph
50	720	2200	Westinghouse
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
35	600	440	G.E.
30	720	220	G.E.
30	514	440	Stanley
25	3600	220/440	L-A
25	1800	220	L-A-HD
25	1200	220	Century
25	900	440	G.E.
25	720	220	Westinghouse
25	600	440	G.E.
20	3600	440	A-C
20	1800	220/440	G.E.
20	1800	220/440	G.E.
20*	1800	220/440	Wesche
20	900	440	A-C
20	600	220	G.E.
15	3600	220	G.E.
15	1800	220/440	G.E.
15	1200	220	Imperial
15	900	220	Howell
15	720	220/440	A-C
10	3600	220	R. & M.
10	1800	220	Westinghouse
10	1200	220	A-C

* New Motors

MULTI-SPEED MOTORS 3 PHASE, 60 CYCLE

HP	RPM	VOLTS	DESCRIPTION
50/12½	900/450	2200	G.E., KT-356
40/20	1200/600	440	Westgh., CS-445
25/12½	1800/900	220	R&M, L-640
20	1860/1200/ 900/600	440	Century, SCN-564Y
20/10	1800/900	220	Century, SCN-27
15/10*	1800/1200	440	Westgh., CS-365
15	1800/900	220	R&M
15/7½*	1800/900	220	Wagner, 364
15	900/450	440	Reliance, B-485 high torque, high slip

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-CW
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	1200	440	Westgh.-CW
300	720	2200	Al. Ch.
300	514	440	Al. Ch. 3 Brg
250	600	2200	G.E.-I17B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2200	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-IM
200	514	440	West.-CW
150	1800	440	G.E.-MT
150	720	2200	Al. Ch.
120	900	550	Ideal
100	720	440	Al. Ch.
100	400	440	West. Elec. (GE)

* New

MOTOR GENERATOR SETS

D.C. OUTPUT KW	Voltage	Description	A.C. INPUT HP	RPM	Volts
1500	600	G.E., MCF	2100	720	13200
860	500	West., 3 unit	1200	1200	2300
750	550	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
600	250	Westgh. (2-300KW Gen.)	1200	1200	2300
500	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
300	250	G.E.	450	1200	2300
200	125	G.E.-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	720	440
150	250	G.E.-Westgh.	200	1200	440
100	250	Westgh.	147	1200	4300
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	80	1200	220/440
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440
12½	230	Westgh.	19½	1800	220
10	250	Westgh.	15	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	A.C. END HP	VOLTS	DESCR.
7500/3750	6/12	270	Munning	60	440	West. CS Sq. Cage
4000	2 to 8	425	Jantz & Leist	—	—	—
2400	40/80	1200	Westgh.	200	440	WH Byns.
1500	3 to 40	900	HVW	100	440	HVWSyn.
1500/750	6/12	1200	Munning Loeb	15	440	GE— I Cage
1000	80	1200	Century	100	440	Century Cage
1000	20	1200	Star. I Brg.	—	—	—
1000	6	1200	Wagner	—	—	—
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	8	GE	Rectifier	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

COMPLETE POWER PLANTS

STEAM — ELECTRIC — HYDRO — DIESEL

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TURBO-GENERATORS—Condensing—500 to 20,000 KW; some extraction type, pressures 200 to 450#

TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450#, some extraction with high back pressure

STEAM GENERATORS—30000# to 100000# per hr. 150# to 450#

BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#

BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#

TRANSFORMERS Quick Delivery, Various Sizes Rebuilt like NEW—Guaranteed. Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

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ACCUMULATOR AND PUMPS

1—7" x 6' inverted accumulator, Mf's. by Chas. Eames Eng. Wks. 37" dial shell. Takes 11,000# ballast for 300# W.P. Max. Work. Height 15'-11", 2" pipe conn. to spindle, new 1943.

2—Worthington. 4½" x 6" vert. triples single acting pumps. 300# P.S.I., motor drive, less motrs., bronze trimmed, new 1943.

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TURBINE & DIESEL GENERATOR SETS

1— 50 KW, West., DC, 120 Volts, 1200 RPM
1—100 KW, G.E., AC, 60/220 Volts, 1200 RPM
1—250 KVA, Elliot, AC, 3/60/220 Volts, 1200 RPM
2—200 KW, G.E., AC, 3/60/220 Volts, 1200 RPM
2— 15 KW, Cat. Diesel, 3/60/120-208 Volts, 1200 RPM
1— 50 KW, Cat. Diesel, 3/60/120-208 Volts, 900 RPM
1— 50 KW, Intl. UD 18, 3/60/120-208 Volts, 1200 RPM
1— 90 KW, Cummins, 3/60/240 Volts, 1800 RPM
1—100 KW, Buckeye, 3/60/2400 Volts, 400 RPM

SLIP RING MOTORS—3 Ph., 60 Cy.

1	40	**Al. Chal.	440	B. Brg.		900
1	50	West.	220	CW		1175
1	60	West.	220-440	CW	706A	870
1	580	G.E.	2300		17B	980
1	*800	West.	440	CW	432015	1800

SYNCHRONOUS MOTORS—3 Ph., 60 Cy. With Direct Connected Exciters

1	75	El. Mach.	220		1200
2	125	**El. Mach.	4800		900
15	135	***G.E.	1800	TS 9632	1200
1	*200	**El. Mach.	208		1200
1	*300	**El. Mach.	208		1200
1	350	**El. Mach.	208		1200

NEW G.E. AC GENERATORS W/PANELS

100—3 KW 3/60/120—208/1800 RPM
50—10 KW 3/60 120—208/1800 RPM

*NEW—**BALL BEARING—***SEP. EXCITER

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210 Snediker Ave., B'klyn 7, N. Y. HYacinth 5-0800

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AMERICAN AIR COMPRESSOR CORP.
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We own and offer subject to prior sale:

6—New 300 KW Crocker Wheeler 1200 RPM 240/120 Volt DC Generators.
8—New 250 KW 240/120 Volt 450 RPM Direct Current Crocker Wheeler Generators.
6—15,000 Lb. Steam Per Hr. 250# steam pressure oil fired packaged type Cade Boiler Units.

SUNDFELT EQUIPMENT COMPANY, INC.
220 Hudson Street Seattle 4, Wash.

1—125 KW 400 RPM 187½ HP Buckeye Diesel Generator Set with all accessories.
1—225 HP Buckeye Diesel 400 RPM Belted Unit

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BREW-WOLTMAN OFFERS

TURBINE UNITS—60 CY.

1—8375 KVA G.E. Cond. 2300 V. 180-lb.
1—6250 KVA Allis Cond. 4000 V. 175-200 lb.
1—5000 KVA West. Cond. Extr. 480 V. 385-lb.
1—3750 KVA G.E. Cond. 2300 V. 185-lb.
1—3125 KVA West. N-C. 480 V. 400-lb. 30-35 lb. BP
1—2500 KVA Worth. N-C. 2300 V. 150-200 lb. 40-lb. BP
1—2500 KVA G.E. Cond. 600 V. 175-lb.
1—1875 KVA West. Cond. 2300 V. 170-lb.
1—1875 KVA G.E. Cond. 2300 V. 180-lb.
1—1563 KVA G.E. Extr. Cond. 2300 V. 200-lb.
1—1250 KVA Allis Cond. 2300 V. 150-200 lb.
1— 938 KVA G.E. Extr. Cond. 240 V. 200-lb.
1— 938 KVA West. Extr. Cond. 2300/4130 V. 200-lb.
1— 938 KVA G.E. N-C 480 V. 150-lb. 10-15 lb. BP
1— 750 KVA G.E. Extr. Cond. 480 V. 200-lb.
1— 750 KVA G.E. Cond. 2300 V. 150-lb.
1— 625 KVA Worth. N-C. 480 V. 125-lb. 10-lb. BP
1— 625 KVA G.E. N-C. 480 V. 200-lb. 30-lb. BP

DIESEL ENGINE UNITS

1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1— 600 HP Enterprise 440 V. 60 cy.
2— 500 HP Winton 2400 V. 60 cy.
1— 250 HP Buckeye 240 V. 60 cy.

STEAM ENGINE UNITS—60 CY.

1—675 KVA Skinner Vertical Uniflow 480 V.
1—250 KVA Ames Vertical Uniflow 480 V.
1—200 KVA Skinner Uniflow 230 V.
2—187 KVA Ames Vertical Uniflow 240/480 V.
1—136 KVA Ames Vertical Uniflow 240 V.

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	VOLTS-DC	A.C.	RPM
1	2000	G.E.	600	4000	450
1	1500	G.E.	600	4150	600
2	1000	West.	600	4150	900
1	500	West.	125	2300	720
1	200	West.	275	2200	900
2	200	G.E.	250	4150	1200
2	150	G.E.	250	2300	1200
1	150	West.	275	440	900
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS—60 CY.

QU.	HP	MFR.	VOLTAGE	RPM
1	700	West.	2300	200
1	600	G.E.	2300	240
1	300	G.E.	2300	600
1	300	West.	2300	900
1	250	West.	440	600

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300
1	1700	West.	60/24	720
1	625	A.C.	25/60	300

OIL CIRCUIT BREAKERS—Outdoor

1— 00 A. 73 KV G.E. FHKO-236-500
1— 400 A. 37 KV G.E. FHKO-136-350
1— 400 A. 37 KV G.E. FHKO-236-500
4— 600 A. 15 KV G.E. FHKO-139-750
1— 600 A. 15 KV G.E. FHKO-136-1328 BS
1—1200 A. 15 KV G.E. FKO-139-350
1— 400 A. 15 KV G.E. FHKO-136-350
1— 400 A. 7.5 KV G.E. FKO-227-50

TRANSFORMERS

4— 2333 KVA West. 69300/66000—33000
4— 500 KVA West. 66000—6900
3— 333 KVA G.E. 69300—2400/7200
3— 300 KVA G.E. 66000/33000—2300, 3 ph.
3— 75 KVA A.C. 66000/24000—7200/12470 Y
3— 200 KVA West. 45000—2400/7200
3— 150 KVA G.E. 44000—7200/12470 Y
3— 75 KVA West. 44000—7200/12470 Y
3— 8333 KVA West. 43800—13900
2— 900 KVA G.E. 36300—2300, 3 ph.
1—18750 KVA A.B.B. 34840—11000, 3 ph/
3— 300 KVA G.E. 33000/66000—2300 3 ph.
4— 200 KVA A.C. 34500—6900/11950 Y
3— 150 KVA Wag. 33000—7200/12470 Y
3— 100 KVA A.C. 33000—7200/12470 Y
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
4— 450 KVA A.C. 25410/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 100 KVA G.E. 22000—7200/12470 Y
6— 200 KVA G.E. 13200—2300
3— 200 KVA G.E. 13200—230/460
3— 200 KVA G.E. 11500—2200/110
3— 150 KVA Wai. 11000—2300
3— 250 KVA Pitts. 7200—220/440
3— 200 KVA Wag. 7200/12470 Y—2400
3— 150 KVA Wag. 6900—2300
4— 100 KVA G.E. 6900/11900—2400
3— 37½ KVA G.E. 6900—230/460
3— 1500 KVA A.C. 2300/4000 Y—2300
3— 333 KVA G.E. 2300—230/460
1— 100 KVA G.E. 2300—575, 3 ph.
3— 100 KVA West. 2300—230/460
6— 50 KVA West. 2400—115/230 DRY TYPE
3— 15 KVA Stand. 450/225—117 DRY TYPE

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1—500 KW G. E. Syn. 250 V. 900 RPM
1—400 KW G. E. Syn. 600 V. 720 RPM
2—300 KW WEST. Syn. 250 V. 1200 RPM
1—300 KW G. E. Syn. 250 V. 1200 RPM
1—300 KW RIDGWAY Syn. 250 V. 1200 RPM
1—240 KW G. E. Syn. 250 V. 1200 RPM
1—225 KW G. E. Syn. 125 V. 1200 RPM
1—200 KW G. E. Syn. 250 V. 1200 RPM
1—200 KW RIDGWAY Syn. 250 V. 900 RPM
1—150 KW G. E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
1—100 KW RIDGWAY Syn. 250 V. 1200 RPM

ROTARY CONVERTERS

2—500 KW G. E. Syn. 25 0V. 1200 RPM
1—500 KW WEST. Syn. 250 V. 1200 RPM
1—300 KW G. E. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
2—300 KW AL-CH. Syn. 250 V. 1200 RPM
1—200 KW G. E. Syn. 250 V. 1200 RPM
1—150 KW G. E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM

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SPECIAL OFFERINGS

TURBO-GENERATORS

2—4000 KW, 2300 V., 150 #Cond.
1—3500 KW, 4000 V., 150# Cond.
1—4000 KW 2300 V., 400# Cond.
1—3000 KW 13,200 V., 425# Extr. 170# Non-Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—1500 KW, 2300 V., 200# Cond.
1—1250 KW, 2300 V., 250# Extr.
1—1000 KW, 2300 V., 175# Extr.
1—1000 KW, 4160 V., N.C. 1949
1— 500 KW, 4150 200# N.C.
2—1000 KW, 480 V., 180# Cond
1— 750 KW Consisting of
1—500 KW, 550 V., AC
1—250 KW, 250 V., DC
Non-Cond. 150#

DIESEL GENERATORS

1—1000 KVA, 2400 V.
1— 700 KW, 480 V.
3— 540 KW, 480 V.
1— 437 KW, 480 V.
1— 200 KW, 480 V.

FIRE PUMP

1—New 1000 G.P. Turbine Driven

BOILERS

3—50,000# pr hr. 275# (1949)
1— 850 H.P. 250#
1— 480 H.P. 225# 1942
1— 400 H.P. 200# 1941
2— 250 H.P. 200# 1940

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THE BUYERS MUST BE SATISFIED—ALWAYS

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-6078	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBB used
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-443	1800	B. B. open

NEW SQUIRREL CAGE MOTORS

H.P.	Make	Type		Speed	Description
75	F.M.	QS-445	1800	B. B. open	
75	West.	CS-505	1200	TEFCBBXP	
60	West.	CS-504S	1800	TEFCBBXP	
60	G.E.	K-5048	1800	TEFCBBXP	
60	L.A.	OG-44	1800	B. B. open	
60	F.M.	QS-444	1800	B. B. open	
50	Master	FB-404	3600	TEFCBBXP	
50	G.E.	K-445	1800	TEFCBB	
50	G.E.	K-405	1800	S. B. drip	
50	West.	CS-445	1200	S. B. open	
50	G.E.	K-505	900	TEFCBBXP	
40	A.C.	AR-444	3600	TEFCBBXP	
40	G.E.	KF-3655	3800	B. B. Splash	
40	West.	CS-405	1800	TEFCBB	
40	L.A.	K-405	1800	TEFCBBXP	
40	G.E.	404	1800	B. B. open	

SQUIRREL CAGE MOTORS REBUILT

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-20	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.

REBUILT SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed	Description
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S.B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S.B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-348	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-348	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

We hav ein stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM.
We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER EQUIPMENT COMPANY

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MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SQUIRREL CAGE MOTORS

3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1	400	Cont.	NZ-806	2300	1200
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
2	300	Whse	CS-8501	2300	1785
1	200	Whse.	CS-8736C	2200	1160
1	200	Al.Ch	AR	440/220	580
2	125	Al.Ch	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	128-Q	440/220	870
2	100	Whse	CS-863C	440/220	1750
1	100	Al.Ch	AR	550	690
1	100	F.M	H241B	440/220	435
1	100	Whse	CS-938	2200	495
1	75	G.E.	I-K15	440/220	570
1	75	Al.Ch	AR	2200	1765

MOTOR GENERATOR SETS

Qu	KW	Make	RPM	Volts DC	Volts AC
1	2400(3-U)	Al.Ch	720	525	4800/2400
1	2400(3-U)	Whse	720	600	4800/2400
1	1000	G.E.	514	550	2300
1	1000(3-U)	Whse	900	250/125	4160/2300
1	500	C.W.	720	250/275	2300/440
2	500	C.W.	720	575	2300/440
1	500(3-U)	Whse	1200	250	440
1	250	Whse	1200	125/250	2300
1	200	Whse	1200	125/250	2300/440
1	200	Ridgway	900	275	2200
1	155	G.E.	720	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	Al.Ch.	2000	125/250	4000/2300
1	100	C.W.	1200	125	440/220
1	100	Delco	1200	125/250	440/220
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	4000/2300
1	75	Star	1200	230	440/220
1	75	Al.Ch.	900	250	2300
1	75	Whse.	900	75	2200

We can furnish any of the above sets with exciters and VARIABLE VOLTAGE CONTROL engineered and rebuilt for your requirements.

SLIP RING MOTORS—CONSTANT DUTY

3-Ph., 60-Cy.

Qu	HP	Make	Type	Volts	RPM
1**	1800	G.E.	MT-498	2300	352
1**	1200	G.E.	MT-26	2200	275
2**	1000	Al.Ch.	ANY	2200	235
1**	600	G.E.	MT-20	2300	360
2	500	G.E.	I-16-M	2300	450
1	400	Al.Ch.	ANY	2200	514
2	400	G.E.	MT-412	2200	450
1	300	Al.Ch.	ANY	2200	514
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT-414	2200	300
1	200	G.E.	I-16 M	2200	600
1	150	G.E.	I-13-M	2200	1750
1	125	Whse.	CW-670	2200	900
1	100	F.M	H20C	440	900
2	100	G.E.	I-15-M	2300	514
1	75	Whse	CW-7540	440	720
1	60	Whse.	C.W.	440	900
1	50	G.E.	MT-536	2200	1200

With the above we can supply manual or full magnetic control, standard or reversing, also with dynamic braking if required.

MOTOR GENERATOR SETS COMPLETE WITH CONTROLS STILL ON THEIR FOUNDATIONS AVAILABLE FOR IMMEDIATE SHIPMENT

(3) West., (4) G.E. 1,000 KW, 600 VDC Generators, compound, interpole, 514 RPM, 1440 HP., syn. motors, 11,000 v., 3 ph., 60 cy. (Will reconnect for 6,600 v.)

(3) G.E. 1,500 KW, 250 VDC, 514 RPM compound, interpole, pedstal windings, 2,100 HP, syn., motors, .8 pf, 13,200 v., 3 ph., 60 cy. (Will reconnect for 6,600 or 4,160 v.)

Priced right for REMOVAL

SYNCHRONOUS MOTORS

3-ph., 60-Cy.

Qu	HP	Make	PF	Volts	RPM
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2100	720
2	2100	G.E.	100	2300	360
2	1750	G.E.	100	2300	3600
1	1000	El.Mchy	100	440	1200
1	750	G.E.	80	2300	450
1	250	G.E.	80	2300	514
1	250	El.Mchy.	80	440	400
1	187	G.E.	80	220/440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	G.E	80	550	450
1	135	G.E.	80	4000/2200	1200
3	125	El.Mchy	100	4800/2400	900
1	125	G.E.	80	2200	900

DIRECT CURRENT MOTORS

Qu	HP	Make	Type	RPM
1***	3000	Whse.	Encl (Rev.)	600
1***	2400	Whse.	Encl.(Rev.)	600
4***	1600	Whse.	Encl.(Rev.)	600
4***	1200	Whse.	Encl.(Rev.)	600
4***	800	Whse.	Encl (Rev.)	600
1	350	G.E.	CD-189-A	1150
1	300	Whse.		240/300
1	200/250	El.Dy.	No. 22	400/1200
1	250	G.E.	MPC	325/975
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	180	G.E.	MPC	400
1*	150	C.W.	83-H	850
1***	125	Whse.	SK-190	600
2	125	Whse.	SK-184	575/850
1	90/160	G.E.	MPC	625/1125

All above 230-VDC except where marked ***.
***—Pedestal bearing mill design 525/600-VDC.
Rev.—designed for mill reversing service.
*—T.E.F.C.

T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40 PENNA

1—400 H.P. Keeler C.D. Integral Type Water-tube Boiler with complete Tood Oil Burner Installation. Design Pressure 160#. Built 1940.

1—350 H.P. Cleaver-Brooks, 150# pressure. No. 6 oil. Complete with pumps and receiver set. All trim.

1—600 H.P. B.&W. Sect. Header Boiler, 200#.

1—150 H.P. Bros 150# w.p., 3 drum, Bent tube, self contained, steel encased, brick lined. 9000# steam per hour.

1—125 H.P. Erie City Economic, 125# pressure. Complete with stack and trim.

Miscellaneous Scotch Marine Boilers, 75 to 150 H.P. available.

A Number of Self-Contained & Economic Units, 50-150 H.P., 100-200 Lbs. Pressure.

2—Detroit Roto-Spreader Stokers for 300 H.P. Boilers, nominal rating.

Combustion Engrg., Spreader Stoker complete with fan & Hogan Controls-Stoker. Designed for 600 H.P. boiler at 200% of rating, or 1200 H.P.

1—6 Cylinder Enterprise Diesel 800 H.P. direct connected to 1000 K.V.A., 3 ph., 60 cyl. 2400 V. Elliot Generator complete with all aux. Unit built 1948, 1400 hrs. use only.

1—750 K.W. and 1—500 K.W. DC 240 V Generators dir. conn. to 2—Westinghouse non-cond. Turbines—3600 r.p.m. reduced to 900 r.p.m. on generators. Includes switchboards.

1—250 H.P. Cleaver-Brooks, 15# w.p., #6 oil, Built 1946.

WARNER J. SHERB, INC.

342 Madison Avenue, New York, N. Y.

Telephone MUrray Hill 2-9098

AC MOTOR

3 Phase, 60 Cycle

1—6000 HP at 93-1/3 Cycle 400 RPM or 3800 HP at 60 Cycle 257 RPM, GE

AC DIESEL GENERATOR SET

1—210 KVA Chicago Pneumatic 4-H-40-S

POWER HOUSE EQUIPMENT

2—6000 KVA, 3ϕ, 60 cycle, 13,200/2940 V. Westinghouse transformers

6—2000 KVA, 1ϕ, 60 cycles 13,200/2870 V. Westinghouse transformers

EASTERN SCRAP & SALVAGE CORPORATION

65 Muirheid Avenue, Trenton 7, N. J.

Telephone 5-6349

Turbo Generators, Boilers, etc.

4000 KW Condensing 275#. Extraction 30#.
3125 KVA Non-Cond. 400#g. 35# exhaust.
3000 KW Non-Condensing — Extraction 425#g. 60# exhst. 170# extrac.
100,000# per hr. B&W 250# Intgr. Furnace.
100,000# per hr. B&W 450# Sterling.
87,000# per hr. 350# Steam Generator.

also

3500 KW GENERATOR 3/60/2300v. 3600 RPM rewound—overhauled, never used.

STEPHEN A. DOUGLASS CO.

630 Ft. Washington Ave., New York 33, N.Y.

480 HP BUCKEYE

Diesel Engine, 8 Cyl., 10½" x 12" Stroke, 600 RPM, Model 80, late type. Rebuilt.

600 KW Direct Current General Motors Diesel set. Westinghouse Generator 720 RPM, 500 volts, electric start. Unused.

ALJON ELECTRIC DIESEL CO.

904 Pacific Street • Brooklyn 16, N. Y.

STerling 3-6515

150 KW AC Gen. w Skinner Unaflow
100 KW AC Gen. w Chase N.R. Corliss
30,000' 1.0 Trenchlay Cable
200—150—100—60 HP Rebuilt Motors
300,000 & 100,000 Gal. T. & Towers
20 HP 100# Cyclotherm Boiler
100 HP 125# Dutton Brand New Boiler
150 HP 150# Code Erie Econ. Boiler

H. & P., 6719 Etzel, St. Louis 14, Mo.

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.
Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

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2457 WOODWARD AVE.
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DETROIT 1, MICH.

GET MORE FOR YOUR MONEY FROM HEMPHILL GUARANTEED EQUIPMENT

GUARANTEED GOOD BECAUSE REBUILT AND TESTED BY HEMPHILL ELECTRICAL ENGINEERS

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph.	Voltages
1	1500	Penna.	OISC	3	4150x2400
1	1500	GE	Pyranol	3	4150x2400
1	500	Kuhl.	OISC	1	4600x2300
2	400	Plitz.		1	2400/4800x240/480
1	333	GE	OISC	1	13200x220/440
3	333	West.	OISC	1	2300/575
1	200	GE	HT	3	2300x220
1	200	Plitz.	ODSC	1	4000x110/220
1	200	Mol.	C	1	2300x220/440
3	100	Wagner	HEB	1	240x120/120
1	100	Amer.		1	15000x2300
3	100	GE	Auto	1	4150Yx2400Y
9	50	GE	H	1	13750x125x216Y
1	50	Al. Ch.	ODSC	1	13530x120/240
2	50	Plitz.	Sub	1	13530x120/240
1	50	Amer.	OISC	1	6600/13200x220/440
1	50	Amer.	WF	1	240x240/30
1	50	GE	KS	1	2300x230
1	50	Amer.	AT	1	220/250/44
1	37½	GE	H	1	2200x110/220
1	37½	Amer.	RS	1	6900/13800x220/440
1	37½	Amer.	OISCID	1	6600/13200x220/440
2	37½	Amer.	AT	1	220x220/44

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
1	150	GE	720	ATI	2300
1	150	GE	1800	T8	220
1	150	Whse.	900		220

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
7	1000	GE	514	600	2300/4150 Syn.
1	200	Whse.	900	250	220/440 Syn.
1	150	GE	120	125/250	2300 Syn.
1	150	Whse	600	125	4150 Syn.
1	125	CW	1200	125	220/440 SC
1	100	GE	900	250	2300 Syn.
1	94	GE	1200	60	440 SC
1	94	GE	1200	60	4150 Syn.
1	30	GE	900	230	220 Syn.

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	1750	GE	4160	K	3000 Sq. Cg.
1	500	GE	440	IM	900
1	400	Whse.	450-5	CW	550
1	250	Whse.	600	CW	440
1	200	GE	1800	MT	2,300
1	200	Whse.	600	CW	440
1	200	GE	600	MT	440

SLIP RING MOTORS—(Con't)

1	100	GE	600	IM	440
1	75	GE	1200	MT Vert.	220
1	60	GE	1750	MT	220
1	60	GE	900	MT	440
1	50	GE	1720	MT	220
1	50	Whse.	900	CW	220
1	50	GE	1700	MT	220
1	50	GE	600	MT	220
1	40	G.E.	1200	MT	220

TURBO GENERATOR

250 KVA Elliott 208V 200# non-cond.

SPECIAL M.G., A.C. WELDER

1—170 KVA Whse., 220 V, 57 PF, 1200 RPM, 1 ph., with 75 HP Slip Ring, 440V, type CW, Exc. & Control

SPECIAL WELDING

1—150 KVA GE, type KWC, 1 ph., 550 V, sec. 12.22/6.05 V, Thyratron Spot and Seam, Control CR 7503

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PHONE NEW YORK LONGACRE 5-3237

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BARGAINS IN STOCK

2000 KW. 3-60-2300 G.E. Turbo-Gen. cond.
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750 KW. 3-60-600 G.E. Turbo-Gen. ext.
500 KW. 3-60-480 G.E. non condensing.
1800 Sq. Ft. C. H. Wheeler surface condenser. C. H. Wheeler air ejector.
806 Cu. Ft. Chicago Pneumatic Compressor.
500 KW. 250 v. Gen. Elec. rotary.
2000 Amp. 8 volt Plater
100 KW. 250 volt Motor-Generator.
150 KW. 250 volt Motor-Generator
500 KW. 250 volt, 900 RPM. Generator.
75 KW. 125 volt motor generator.
50 KW. 3-60-440 Caterpillar diesel.
30 KW. 3-60-220 Ready Power Plant.

Large Stock: 110 and 220 volt DC motors, constant and adjustable speed.
Thousands of 3 phase motors, all types and sizes.
Oil Circuit Breakers.
Line Voltage Regulators.

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A few of our offerings

2—1373 H.P. B.&W. Straight Tube Sectional Headers, Cross Drum, Boilers, 250# W.P., A.S.M.E.
2—150 H.P. D. M. Dillon Scotch Marine Boilers, 165# pressure, A.S.M.E., N. Y. Standard. Oil Fired, Still Operating. Available in September.
3—600 H.P.; 2—750 H.P. B.&W. Boilers. Straight Tube, Sectional Steel Headers, 225# W.P.
1—150 KW, 3,00/440V. Sterling Gasoline Engine Driven Generator.

TURBO-GENERATORS

1—1000 KW, 1—750 KW, 1—500 KW, Non-Cond. 15# B.P. 3/60/480 V.

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We buy entire power plants. What have you to offer?

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One Year Guarantee.

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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

RUBBER MILLS

2—Farrel-Birmingham 18" x 42", 13⅛" bearings, with a 75 H.P. synch. motor.
1—Calender 6" x 12" w.s. Rolls, motor driven.

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500 KW G.E. M-G SET

700 HP ATI-C-SYN.—3/60/2300—720 RPM—500 KW MPC—6—275 V. D.C.
Factory Built Unit. Good Condition. Reasonable Price.

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SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
500 (2)	2200	G.E.	900
500	2200	G.E.	450
450	440/220	Whse.	514
350	2200/440	G.E.	450
300	2200	G.E.	360
300	440	Whse.	3600
250	440/220	Whse.	600
250	2200/550	G.E.	450
250	550/440	G.E.	1200
250	440	G.E.	600
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	440/220	G.E.	450
150	440/220	Whse.	600
150	440/220	Whse. (2)	1800
145	4000/2300	G.E.	1800
125	2200/440	G.E.	600
125	550/440	G.E.	1200
100	440/220	G.E.	600
100	440/220	G.E.	900

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
250	4000/2300	El. Mchy.	Syn.	600
240	2300/440	G.E.	ATI	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2300/440	Whse.	GE	600

PLATING UNIT

1—5,000 amp., 4/8 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator dir. conn. to 50 hp, G.E sq. cage motor.

CIRCUIT BREAKERS

2—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse., 3 pole, 600 v., air
1—400 amp., 37500 V., G.E., Type FHKO-236 outdoor type, high interrupting capacity.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
650	440	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
300	2200	G.E.	FT	3600
250	440	G.E.	IK	720
250	2200	Al. Chal.	AR	1800
200	2200	G.E.	K	900
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
150	440	Multi sp.	KT	1800/600
150	440/220	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	R. Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
150	2200/440	G.E.	KT	600
100	2200/440	G.E.	K	1200
75 (5)	550	G.E.	KF	1800

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E
1—275 kva, 1200 rpm, 440 V., G.E
1—250 kva, 720 rpm, 2300/440 v., G.E
1—225 kva, 600 rpm, 220/440 v., G.E.
1—187 kva, 1200 rpm, 440 V., Whse.
1—150 kva, 900 rpm, 480/240 v., G.E.
1—100 kva, 720 rpm, 440 v., G.E.
3— 75 kva, 1800 rpm, 440/240 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
225	230	G.E.	CD	600
150	230 (2)	Whse.	SK	650
125	230	Whse.	SK	350/1050
100	230	El. Dyn.	50-3	475/1250
100	230	Cr. Wh.	CMC	625
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—250 kw, 1200 rpm, 250 V., Whse., conn. to 375 HP, 1200 rpm, 2200 V., syn.
1—175 kw, 1200 rpm, 230 V., G.E., conn. to 250 kva, 1200 rpm, 2300/440 V., syn.
1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/400 v., syn. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous.
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage.

TRANSFORMERS 60 CY.

3—333 kva, G.E., 13,200—2300 V.
1—300 kva, Al. Chal, 4600/4160—240/120 V., 3 phase
3—250 kva, G.E., 2400-480 volts
3—250 kva, Whse., 11,000/22,000—2300 V.
3—200 kva, Whse., 2400—240/120 V.
1—150 kva, Whse., SK, 13200-125/215 v., 3 ph.
3—150 kva, Al. Chal., 2400-240/120 V.
3—150 kva, Whse., 2400-240/480 V.
3—100 kva, Whse., 2400-240/480 V.
6—100 kva, Whse., 2400—120/240 V.
7—100 kva, G.E., 4150—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
6— 50 kva., G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry

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STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.
1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.
2—8000 HP Webster Water Heaters.
1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.
6—Steel Coal Bunkers, 80 tons each.
1—30" Wheeler Single Stage Circulating Pump, 35,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 380 RPM. (Has extra impeller for 45,000 GPM)
1—4"x6" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.
1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, Type SG, 3600 to 1200 RPM.
1—Type 1A-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-Stage Steam Turbine, 1750 RPM.
1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-stage Steam Turbine, 1800 RPM.
1—Combination Circulating Pump and Condensate Pump driven by 100 HP General Electric single Stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.
1—2" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Head at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.
1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
1—500 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.
1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.
7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.
1—Kennecott Pressure Type Industrial Water Filter.
1—50-Ton Electric Traveling Crane—55'3½" Span.

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WE OWN AND OFFER FOR SALE — SINGLE OR ALL

A COMPLETE FULL AUTOMATIC STEAM POWER PLANT.
FOR IMMEDIATE DELIVERY.

3—525 HP. 200# 4 Drum Sterling Type Water Tube Boilers. Stamped Ohio Standard. National Board. A.S.M.E. Code. H.S.B. and Registered. With no recommendations on Last Recent and Final Inspection Report. Boilers are Fired with 9 Todd "Duo-Press," with Vee-Cee Oil Burners. Drilled for Gas Rings. Has Fireye Steam and Electric Oil Pumping Heaters. Diamond Soot Blowers. Breechings. 2000 H.P. Cochrane Feed Water Heater. Oil Filter. Continuous Boiler Blow Off System. Flame Control. Smoke Density. Recorder, Pumps, 2—14,000 Gal. Oil Storage Tanks, Pumps, Coal Bunkers and Ash Conveyors, Etc.

BOILERS—New and Used—Not abused. All Makes, Types, Sizes and Pressures. N.B. A.S.M.E. and Insurance Approved. We welcome your inquiries.

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APPARATUS EXCHANGE — Two Rector St., New York 6, N. Y.

DIESEL GENERATOR

25 KW 230 V, 3 ph., 60 cy. generator. Direct coupled to Hill Diesel Model 6R rated 44 HP at 1,200 RPM. This standard gen. unit, complete with panel board is practically new and will be sold under guarantee. Can be inspected under operation.

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USED MINING MACHINERY ELECTRICAL EQUIPMENT

2—150 H.P.—H.R.T. 150 P.S.I. boilers
1—125 H.P.—H.R.T. 150 P.S.I. boiler
1—150 H.P.—125 lb. P.S.I. Scotch marine boiler
Electric mine hoist G.E. motor 52 H.P. 1600 Ft. ⅞ cable
2—General Electric A.C. generators type A.T.B.—36-250-200, 3 phase 250 KVA form E.K.W. 250 PF-1, 2300 volts, 626 amps., speed 200.
Large assortment of electric motors from 3 H.P. up to 50 H.P. Transformers from 3 KVA to 75 KVA

ALBUQUERQUE IRON & METAL CO.
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ONE ASH HOPPER on steel tower with skip and electric hoist.
ONE BEAUMONT & CO. 30x30 two row COAL CRUSHER.
ONE BEAUMONT & CO. coal handling FLIGHT CONVEYOR with coal handling larry.

KLATZKY BROTHERS, INC.
CALUMET, MICHIGAN

FOR SALE

AMES UNAFLOW ENGINE

1—10" x 12", 4-Cylinder, Vertical, Right Hand Poppet Valve AMES UNAFLOW ENGINE, Direct Connected to Westinghouse AC Generator, 312 KVA, 250 KW. Complete with Exciter and Switch Board Panel Equipment. New 1929. Overhauled 1951. For further details write:
FOSTER MACHINE COMPANY, Westfield, Mass.

TURBO-GENERATORS
AVAILABLE IMMEDIATELY

1—6250 kva 5000 kw 3600 rpm Allis-Chalmers 200 lbs. 100° SH condensing. Will operate 275 lbs. 615° TT without change. Generator 3/60/11500 can be changed to 2400/4160 V. Complete auxiliaries—can be operated for inspection. Checked by factory engineer in September 1951—no repairs required.

1—1875 kva 1500 kw 3600 rpm General Electric 150 lbs. 0° SH condensing. Generator 3/60/2300.

1—1567 kva 1250 kw 3600 rpm Allis-Chalmers 150 lbs. condensing. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.

1—1250 kva 1000 kw 3600 rpm Westinghouse 185 lbs. 100° SH condensing. 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.

1—937 kva 750 kw 3600 rpm General Electric 150 lbs. condensing. Generator 3/60/2300.

1—625 kva 500 kw DeLaval geared 5000/900 rpm 150 lbs. condensing. Generator 3/60/2300. Can operate 275 kw 10 lbs. BP without change.

1—1871½ kva 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH non-condensing. Generator 3/60/240.

1—125 kva 100 kw West. geared 7200/900 rpm 150 lbs. non-cond 3/60/240.

1—500 kw 3600 rpm GE non-condensing 175 lbs. throttle 30 lbs. BP 3/60/2400.

ALSO IN OUR STOCK

BATTERY CHARGER
2—400 amp 42 volts Hirtner M-G set 3/60/220-440 with complete D.C. control and motor starter.

COMPENSATORS, A.C. AUTOMATIC
75 hp 3/60/2300 Cutler Hammer Bul. 9622 w/current limit, fuses. New
125 hp 3/60/2200 G.E. CR7051-H1A.

COMPENSATOR, A.C. MANUAL
100 hp 3/60 2200 Westinghouse Type A

CONDENSERS
2—725 sq. ft. C. H. Wheeler 2 pass surface. New

COMPRESSORS, AIR
1000 CFM @ 225 rpm CP 2 stage 20"x12"x14" short center belt drive.

DIESEL GENERATORS
250 kw 400 rpm 3/60/220-440-2200 Superior YLO

ENGINE GENERATORS
2—65 kva 327 rpm 3/60/220 Engberg 9x10 vertical 175 lbs. non-condensing.

GASOLINE ENGINE GENERATORS
50 kw 1800 rpm 3/60/220 Waukesha-Bardco on wheels.

GENERATORS, A.C.
375 kva 225 rpm 3/60/220 Allis-Chalmers engine type
250 kw 1800 rpm 3/60/2200 Westinghouse ped. brgs.
200 kw 720 rpm 3/60 any voltage GE ped. brgs.

GENERATORS, D.C.
75 kw 1200 rpm 125 V. GE single brg.
20 kw 1200 rpm 125 V. GE CDM

MOTORS, SLIP RING
350 hp 360 rpm 3/60/2200 GE Type IM
200 hp 1800 rpm 3/60/2200 GE Type IE 13B
200 hp 1800 rpm 3/60/440 GE Type IM
100 hp 900 rpm 3/60/440 GE Type MTC5346
100 hp 4/50 rpm 3/60/2300 G.E. Type I.M.
75 hp 1800 rpm 3/60/2200 Westinghouse C.W
2— 75 hp 720 rpm 3/60/2200 Westinghouse HF
50 hp 720 rpm 3/60/2200 GE Type MT552
50 hp 900 rpm 3/60 2200 GE Type IM

MOTORS, SQUIRREL CAGE
125 hp 3600 rpm 3/60/2200 GE Type FT
50 hp 720 rpm 3/60/2200 GE Type KT546

MOTORS, SYNCHRONOUS
400 hp 1800 rpm 3 60/2200 Westinghouse ped. brgs
200 hp 720 rpm 3/60 any V. GE Type ATI ped. brgs

MOTOR-GENERATOR SETS
1000 kw 600 V. 514 rpm Westinghouse 1440 hp any voltage syn. motor

PUMPS, BOILER FEED
750 gpm 450 lbs. 3600 rpm Goulds 3360 4"—4 stage
475 gpm 750 lbs. 3600 rpm Goulds 3360 3"—6 stage
2—150 gpm 230 lbs. 2750 rpm Frederick steam turbine

OIL CIRCUIT BREAKERS
600 amp. 110,000 V. Max. GE FK0136 outdoor
600 amp. 15000 V. West. FO221 o/d solenoid oper.
600 amps. 15000 V. Conduit Oil o/d solenoid oper.
9—1200 amp 15 KV Westinghouse CO-11 De-Ion Grid 500,000 KVA 125 v. D.C. solenoid indoor
1—2000 amp 15 KV Westinghouse CO-11 De-Ion Grid 500,000 KVA 125 v. D.C. solenoid indoor
2—800 amp. 15 kv 130,000 kva West. Type B-20 indoor
1—400 amp 73 KV Gen Elec FK0236 outdoor
10—400 amp. 15 kv 130,000 kva West. Type B-20 indoor

TRANSFORMERS, 60 CYCLES
2—1000 kva self cooled (1800 kva water cooled) 3 ph. 60 cy. GE 6600 to 440 V.
2—1000 kva 13800/2300 V. 1 Ph. GE Type H Form VDDJ
3—75 kva 2400-4160/240-480 V. 1 Ph. GE Type H Form KF
3—37½ kva 2400-4160/120-240 V. 1 Ph. GE Type H Form K
121—10 kva 2400-4160/120-240 V. 1 Ph. Various Makes—All modern
20—7½ kva 2400-4160/120-240 V. 1 Ph. Various Makes—All modern
36—5 kva 2400-4160/120-240 V. 1 Ph. Various makes—all modern

TAMPA ARMATURE WORKS INC.
401 S. MORGAN ST. PHONE 2-1966 TAMPA, FLORIDA

BOILER FEED PUMPS

2—A.-Ch. 400 G.P.M., type ML, 6 stage, size 5 x 4, 1614 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6", 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.
Pumps above are mounted on basis for motor or turbine drive.

We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

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Two 250 HP B. & W. Water tube boilers, now in operation under Hartford Inspection at 160 pounds. All pipe, valves, and accessories included with 150 ft. steel stack. Available immediately.

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TRUMANN, ARKANSAS

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1000 horsepower

NORDBERG DIESEL ENGINE

Type TA-174. Four Cylinder, Air Injection, with complete auxiliaries such as pumps, coolers and starting air equipment.

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TWO PRACTICALLY NEW WORTHINGTON CARBONDALE

REFRIGERATION COMPRESSORS
300 Ton Freon
Ideal for large plant or office building
WILL SACRIFICE

WINSTON MACHINERY CO., INC.
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INDIANAPOLIS, INDIANA

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1—833 KVA Westinghouse transformers OISC, 1 ph., 2400/4160Y to 480 volt, Type SL, Ser. 2,150,000
1—150 KVA Westinghouse Transformers OISC, 1 ph., 60 cy., 2300 to 460/230-115, Type SK, Ser. 528371, -2, -3
3—50 KVA Moloney Transformers, with taps, OISC, 1 ph., 2400—120/240, Type HE, Ser. 245403, -6, -7
1—100 HP Allis Chalmers, Slipring, Type ARY, BB, 3/60/220/440 900, Frame 826E
3—100 HP, 1800 RPM Westinghouse Se. Cage, type CS 863C, 3/60/220/440
1—125 HP, 600 RPM, EM, Synchronous 3/60/2200 type BRKT
1—500 KW, M-G Set, 250 V DC, 900 RPM, Syn. drive, 3/60/2300, Wbse. Factory Set.
1—290 KW MG set, 125 V DC, 900 RPM Syn. drive, 3/60/2300 E.M., Factory Set.
2—24x24 Dayton Dowd CS24, 16,500 GPM, 18.5/35 FT HD., 360/450 RPM

BENSON-WILIMZIG, INC.
PHONE GARFIELD 4288
1708 NORTH EIGHTH STREET
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COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

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Condensing—3 phase, 60 cycle

25,000 KVA-20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° T.T. complete shaft exciter, switchboard, a 30,000 square foot Westinghouse surface condenser and accessories.

6250 KVA G.E., 5-stage, 2300/4160 volts, 200# P.S.I., 600° TT.

3750 KVA Westghse. 2300 volt, 200 PSI.

2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, 2-bearing generator **LESS TURBINE.**

2500 KVA Westghse. 2300 volt, 250 PSI.

1563 KVA Allis, 600 volts, 200 PSI.

1000 KVA G.E., 2300 volt, 250 PSI.

Non-condensing—3 phase, 60 cycle

1563 KVA G.E. 480 volt, 200-250 PSI, 15 to 20# ga. back.

940 KVA Allis 2300/480 volts, 125-150 PSI 12# back.

625 KVA G.E. 2300/480 volts, 125-150 PSI 20# back.

375 KVA Westg. 480 volts, 250#.

125 KVA Westghse. 2400 volts, 250#.

Direct Current

500 KW (2) Westghse. 3-wire, 250 volt, 285 PSI, condensing.

500 KW G.E., 250 volt, 200 P.S.I., 25# gauge back non-condensing.

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.

100 KW (2) G.E., 125 volts, 200-275 PSI.

75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.

60 KW (2) Elliott, 125 volt, 200-250 P.S.I. non-condensing, exciter sets.

1000 KVA Westghse., 3 phase, 60 cycle, 2300/4000 volt, 600 RPM generator complete—Practically New.

UNAFLOW GENERATOR UNITS

3 Phase, 60 Cycle

625 KVA G.E. 240 volt generator connected 29" x 36" Skinner horizontal engine, 150 PSI complete.

500 KVA G.E. 240 volt generator connected Skinner Vertical engine 150-175 PSI complete.

375 KVA Westghse, 2400/480 volt generator connected Ames Vertical engine, 150 PSI.

175 KVA Westghse, 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

Direct Current

400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.

250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.

20 KW Allis 125 volt generator connected Hill vertical Diesel engine.

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Good Used Boilers for IMMEDIATE SHIPMENT!

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1—500 HP CLEAVER BROOKS Steam Package Generator 200 lbs. Late Model. Used only few months. Heavy Oil. Fine condition. No. 1019

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(Used Equipment Dept.)

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51 Ft. of 6"x6"x¼" Copper Bus

103 Ft. of 4"x4"x¼" Copper Bus

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RHINELANDER, WISCONSIN

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IMMEDIATE DELIVERY

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2400-KVA Westinghouse Capacitor Assembly, including 96 F.P. rack-type, 25-KVA capacitors, Y-connected for 13.2-KV; outdoor rack, oil switch, fans, protective devices and accessories.

Other New Chemical and Electrical Equipment from $1½ Million Plant Cancellation:

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IMMEDIATE DELIVERY
AIR COMPRESSOR

876 cfm Chicago Pneumatic 100 lb. pressure 2300 or 440 v. A.C. syn. motor complete with starting equipment.

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4	15	G.E.	2200	110/220
10	25	G.E.	2200	110/220
3	25	West.	2200	110/220
1	39	G.E.	2200	110/220
9	37½	G.E.	2200	110/220
2	40	G.E.	2200	110/220
11	50	G.E.	2200	110/220
3	50	West.	2200	110/220
3	75	West.	2400	120/240
1	75	West.	13200/6600	2300
1	75	Pgh.	4800	115/230
1	100	Pgh.	2300/4800	115/230
6	100	Pgh.	4600	115/230
1	100	West.	2300	230/460
2	150	Pgh.	4800	115/230
1	150	G.E. (3 Ph)	2200	240/480
3	200	All. Chal.	22000	2300
3	200	Pgh.	25000	460
2	250	G.E.	2400	480

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SPECIAL BARGAINS
DIESEL ENGINE GENERATOR SETS

4—100 KW., 120/240 V. D.C. Delco Generators dir. con. to 150 HP., Model GBD-3, 3½ x 7, 8 cyl., Superior Diesel Engines, elec. start, power panel, accessories. Practically new—only used for spares.
1—100 KW., 220/440 V. A.C. 3 ph. 60 cy. West. Gen. dir. con. to 150 HP. Superior Diesels same as above.
1—90 kva. Fairbanks Morse 220/440 V. 3 ph. 60. cy., 360 rpm. DIESEL.
1—37½ kva. 3 ph. 60 cy. 127/220 v. or 220/440 v. 1200 rpm., Century A.C. Generators with dir. con. exciters driven by 70 HP., 4 cyl. Model UD-14 International Harvester DIESEL Engines with panels.
2—25 kva. 120 v. 1 ph. 60 cy. Westinghouse dir. con. to 50 HP., 4 cyl. 900 rpm., LeRoi Gasoline Engines with control panels.
3—25 kw., 220/440 v. 3 ph. 60 cy. Westinghouse direct connected to 4 cyl. LeRoi Gasoline valve in head liquid cooled Engine complete with control panels.
17—7½ KW., 120 V. 1 ph., 60 cy. Continental Gas Engines.
2—New 5000 Watt—115/230 V., 1c, 60 cyl. Wisconsin Gas Engines.

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230 Volt D.C.

Qu.	H.P.	Make	Type	RPM
4	30/40	West.	MC-50	525/440
2	15	West.	K-8	610
5	7½/6¼	West.	K-3	585/680

DC VARIABLE SPEED MOTORS
230 Volts

HP	MAKE	RPM	TYPE
400	All. Chal.	400/1200	
125	Westg.	135/500	BB Anti-Fric.
100	Westg.	300/1000	SP BB
75/150	G.E.	300/1200	CD-18B BB Enc.
75/100	Westg.	600/1300	SA-13L SB
50	G.E.	600/1200	LC
50	Reliance	400/1600	T-985F TEFC BB
50	Reliance	300/1200	T1985T BB
50	Crkr. Whlr.	1300/200	CMC-8B
40/50	Reliance	500/1500	T-461T BB
40	Westg.	750/1500	SK-140
40	Al. Chal.	575/1150	E-145
40	Reliance	500/1500	T-461F TEFC BB
40	Reliance	400/1600	T-615F TEFC BB
40	El. Gen. Co.	385/1200	Frame 1608
35	G.E.	625/2100	COM-1029 AE
35	G.E.	350/1400	RF-162 SS
30/40	Imperial	400/1600	D-D69 BB DP
30/40	Reliance	300/1200	T-851 TE BB
30	Westg.	1150/1750	SK-135 TEFC BB
30	Reliance	400/1600	T-461F TEFC BB
30	Imperial	400/1600	D-D69 BB DP
25	Reliance	400/1600	T-310F TEFC BB

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Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

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4—STERLING VIKING Diesels—Model VDS8—650 HP—1200 RPM
2—VENN-SEVERIN Diesel Generators—200 K.W.—3 PH—60 Cy. 240 volt
1—VENN-SEVERIN Diesel Generator—125 K.W.—3 PH—60 Cy. 240 volt
1—ERIE Boiler—150 H.P.—150#—Portable—Firebox Type
1—SULLIVAN 536' Compressor—Direct Connected to Caterpillar Diesel D 13000—Skid Mounted
2—CATERPILLAR 75 K.W. Diesel Generators—3 PH—60 Cy. 220 volt
1—Welder 300 AMP. G.E. Caterpillar D3400 Engine—Skid Mounted

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(Little Used)
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100 H.P. ERIE CITY ECONOMIC BOILER, 125# pressure excellent condition, set for gas or oil firing, complete with trimmings, furnace, gas burner and stack. Price $3500.00 loaded on cars or truck, located 55 miles from New Orleans, La. Address: P. O. Box 3207, New Orleans 17, La.

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HEAVY DUTY DIESEL ENGINE

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12 KW—440 volt—3 phase—60 cycle F.M. diesel, with board and regulator radiator and skid mount—factory rebuilt. $1200.00—original cost over $4000.00.
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1—43 ton G.E. Diesel locomotive—Meters, oil circuit breakers, air circuit breakers, switchboard repairs at a fraction of original cost.

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BROWNHOIST
ORE and COAL
HANDLING BRIDGE

SPECIFICATIONS

Span Length, 342 ft. Overall length, 571 ft.
Apron Length, 81 ft. Cantilever, 148 ft.
Runway, 1556 ft. Trolley rail height, 75 ft.
Traverse, 87 f.p.m. Trolley, 1000 f.p.m.
Hoist, 200 f.p.m. Turntable on trolley.
Coal height, 49 ft. Capacity, 500 tons per hr.
Skew, 35 ft. Screening plant on pier.
Shaker and Vibrator screens, 86 sq. ft. screen area.
Elevator cap. 336 tons per hr. Elevator speed, 177 f.p.m.
D.C. Power, 5-D.C. Motors, 3-200 hp, 2-100 hp.
Span load permitted, 81 tons. Bridge weight, 1191 tons.
Trolley weight, 52 tons. Weight of clam and load, 30 tons.
Clam capacity 16 tons. Automatic clamps at base of piers for wind protection. Rail runway goes with bridge. Generating equipment goes with bridge. Bucket rides with cab. *Blueprints on request.*

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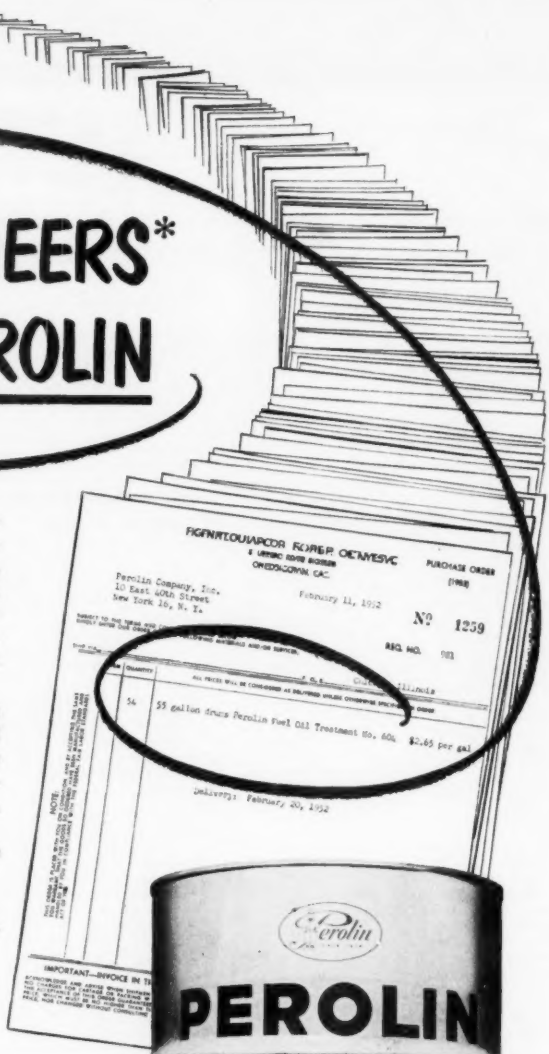
5,596 ENGINEERS* SPECIFY PEROLIN



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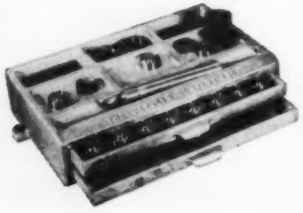
22 WAREHOUSES IN THE U.S. AND CANADA

**Men in charge of commercial oil burning equipment in the U.S.A. and Canada, not counting hundreds abroad, as of May 1, 1952.*

Perolin SINCE 1904

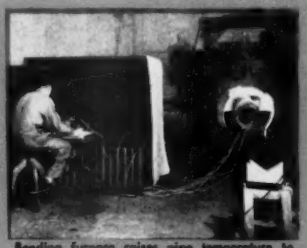


FREE to large users of PEROLIN Fuel Oil Treatment—our Tip Kit, for effective and economical burner maintenance.

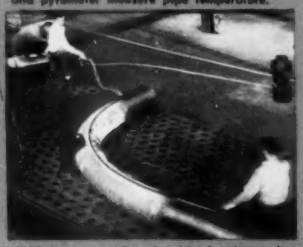
What it takes to make steam behave *at 1450 psi and 1000° F!*

MAIN STEAM PIPING INSTALLED AT SALEM HARBOR STATION OF NEW ENGLAND POWER COMPANY

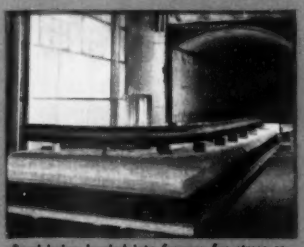
Manufacture of this main steam piping began at Pennsylvania Forge Corporation as 20-ton alloy-steel ingots (2¼% chrome, 1% moly steel). Four days' forging changed the ingots into solid bars 30 ft. long, with outside diameter of 15½ in. Boring, turning, sizing and finishing followed.



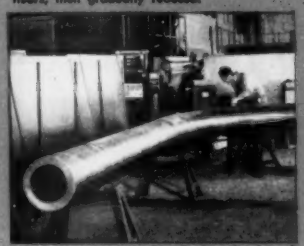
Bending furnace raises pipe temperature to 2000°F in 3 hours, 40 minutes. Thermocouples and pyrometer measure pipe temperature.



Skilled team completes bend in six minutes. Inside surface temperature dropped about 100°F.



Bend being loaded into furnace for stress relieving. Heat maintained at 1425°F for 4½ hours, then gradually reduced.



Ultrasonic inspection of wall after cleaning of pipe shows maximum thinning in bend of 1/16 inch.

FABRICATION of the main steam line for the Salem Harbor Station of the New England Power Company, vital link in more than 52 miles of piping fabricated by Grinnell, is an example of the *many* skills required of Grinnell piping specialists. Grinnell chemists, metallurgists, physicists, radiologists and supersonic electronic scientists . . . *all* played a part in the bending, welding and testing operations.

The integration of complex, highly technical skills like these into a *single* organization of trained specialists explains Grinnell's leadership in the field of prefabrication. It explains, too, why your interests are best served when you call upon Grinnell's expert personnel and specialized facilities in the solution of your piping problems.

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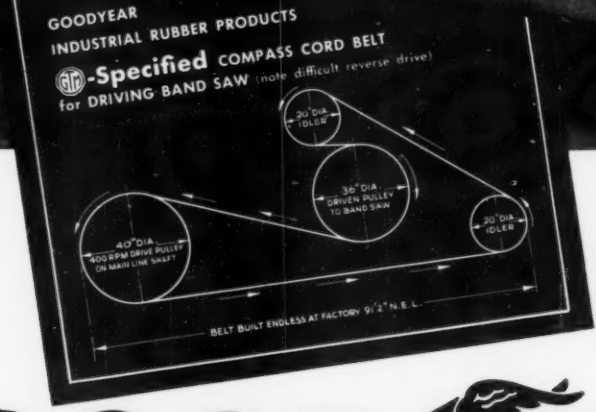
The G.T.M.—Goodyear Technical Man—specified COMPASS CORD belt built with single ply of load-carrying cords. COMPASS has served 13 years so far—still looks good for more service.

The COMPASS belt has never been touched since application—has saved at least $400 to $500 thus far.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for DRIVING BAND SAW (note difficult reverse drive)
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